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COVER: This beautiful selection of turquoise from the Kingman Turquoise Mine was mined and the jewelry produced by Marty and Barbara Colbough of Kingman, Arizona. (Earl Lewis photo)

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Turquoise Renaissance

The Ancient Blue Gem Makes a Comeback!

Natural spiderweb turquoise from Bisbee, Arizona, makes this gold concho belt a real prize. (Photos by the author)

The Vicentis, modern Zuni artists, combine turquoise with other gems like sugilite in traditional pettipoint designs

by Bob Jones

Have you noticed the number of TV and movie personalities wearing turquoise jewelry these days? There's no doubt this ancient blue gem has risen from the grave it was put in 15 years ago. Today, turquoise is in!

The huge surge of interest in turquoise 25 years ago made everyone aware of this classic gem. But poor-quality stones being sold as "the best," the faking of turquoise by dyeing other minerals like howlite, and pricing patterns that got ridiculous gave it such a soiled reputation that it fell into disfavor big time!

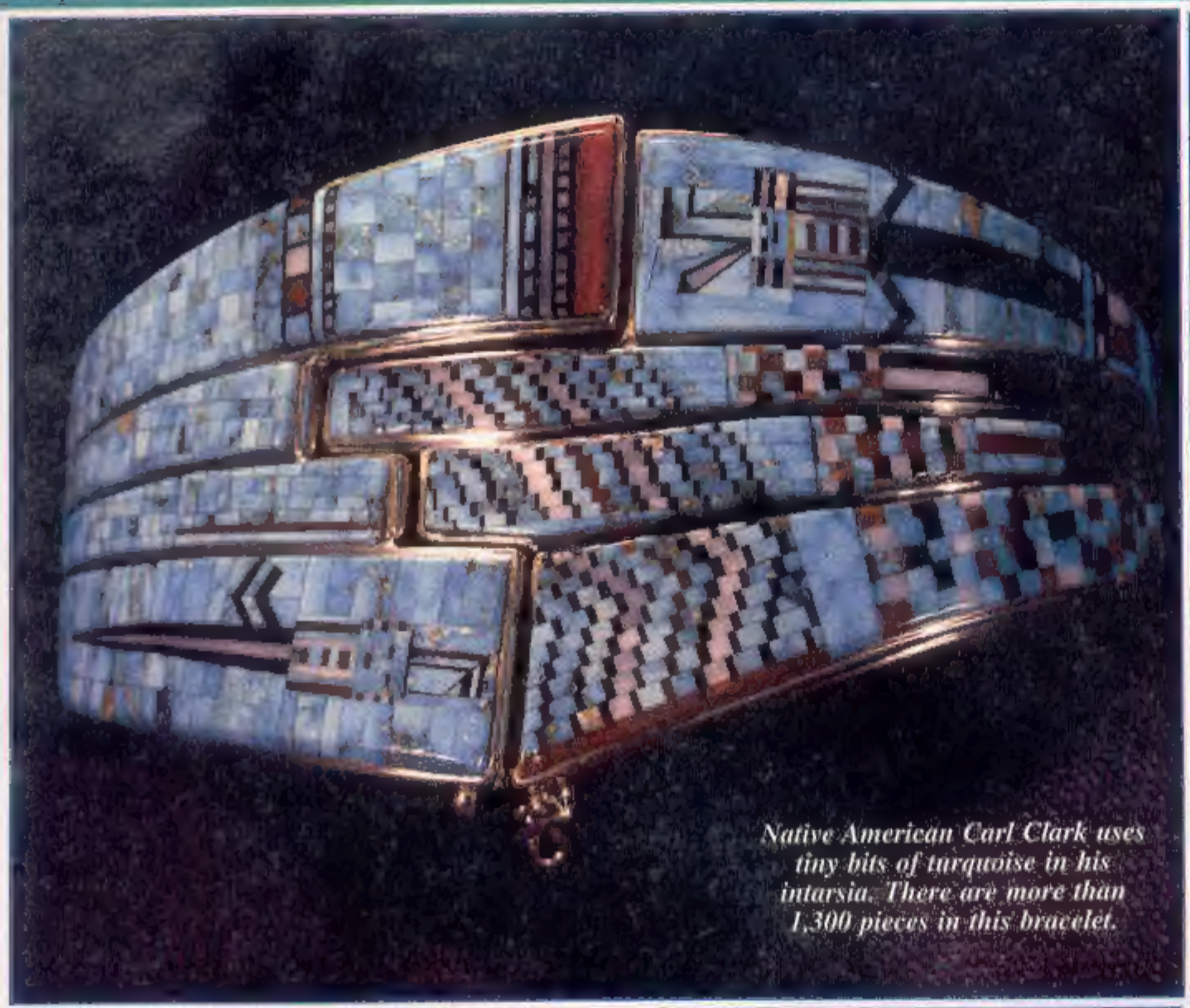
But out of the debris of those frantic times, a few gem artists—many of them talented young Native Americans—developed styles and designs in jewelry that hung on and gradually were recognized for their superb art form and high value. By combining turquoise with other, often more valuable, gems like precious opal, lapis, and even diamonds, these young artists have created an entirely new jewelry art form that has helped bring turquoise out of the doldrums.

In addition, the strong movement toward things natural has resulted in this blue gem being used more and more in its natural nugget form in jewelry. It has become fashionable to wear a string of natural, though usually stabilized, turquoise nuggets as a necklace or bracelet. The rounded pieces are simply polished and drilled for stringing. This contrasts sharply with the shaped and carved pieces mounted in silver of a couple of decades ago.

In high contrast to nugget jewelry, some Native American artists like Jesse Monongye are finally getting the recognition they so richly deserve because they are creating very finely wrought jewelry that is best called intarsia in miniature. Using a variety of gem materials, including turquoise, Monongye and others are actually creating very colorful miniature intarsia landscape scenes or classic Native American designs in necklace pendants and brooches. Imagine a colorful Monument Valley scene in a pendant under 2 inches in diameter.

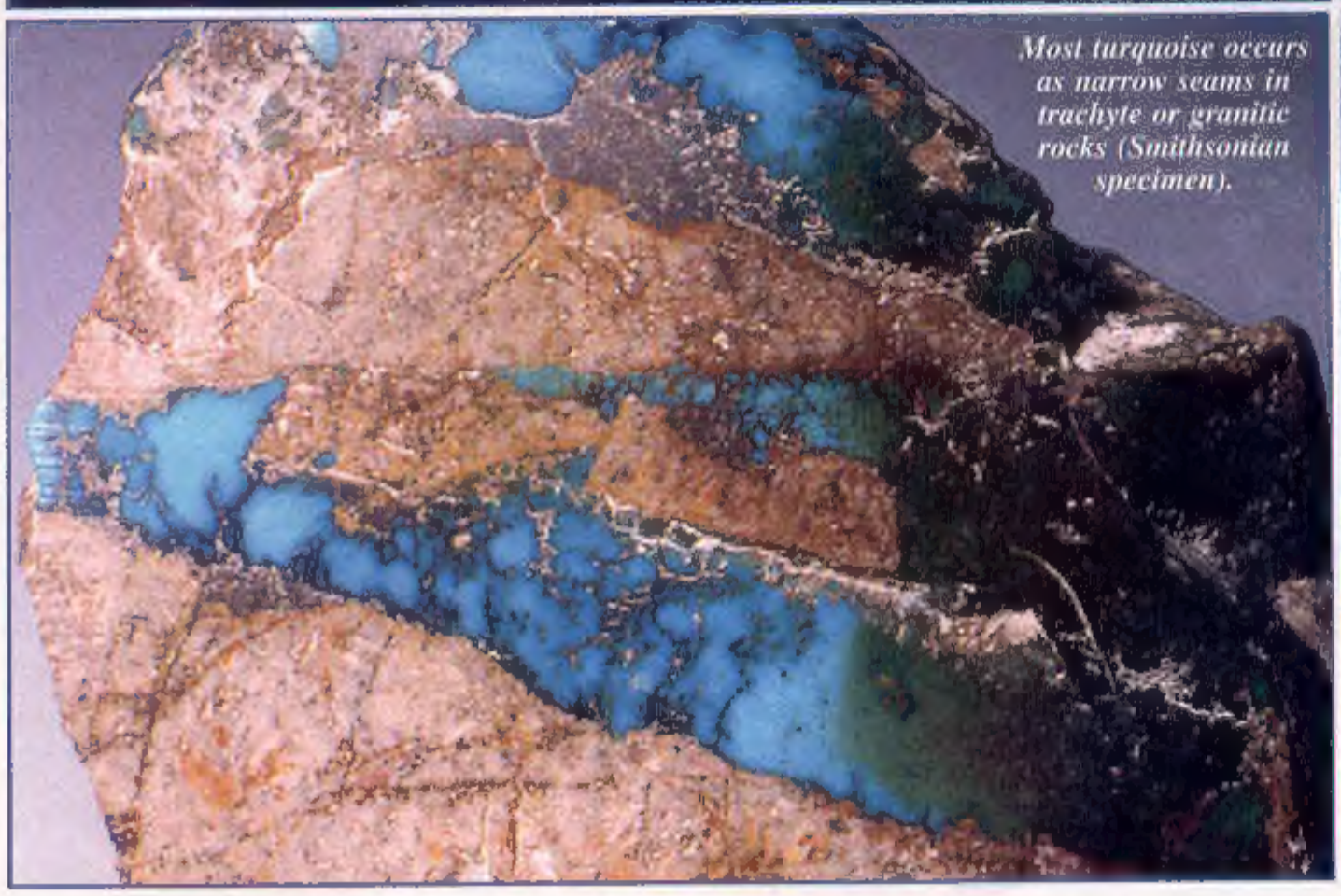
Few artists realize they owe a great debt of gratitude to a fellow named Chuck Colbaugh. Without his curiosity and perseverance, the supply of useful turquoise today would be drastically limited and prices dramatically higher.

It all happened just after World War II. Colbaugh had been in the mining business since the 1930s. He had worked the #8 turquoise mine on Battle Mountain, Nevada, as well as the copper mines of Arizona, so he was very well versed in the full range of turquoise quality. It was in Globe, Arizona, that his curiosity got the better of him. A friend of his was immersing dead scorpions, tarantulas, and other desert creatures in clear epoxy plastic to make paperweights, bola tie ornaments, etc. These novelties were selling like hotcakes to tourists who had never seen a desert denizen. Colbaugh wondered what would happen if a piece of turquoise was enclosed in the epoxy. When he tried it, to his surprise, the turquoise took on a darker blue hue. The epoxy had the same effect as other



Native American Carl Clark uses tiny bits of turquoise in his intarsia. There are more than 1,300 pieces in this bracelet.

Traditional Navajo turquoise jewelry uses natural nuggets, sometimes with contrasting red coral (courtesy Jane Popovich).



Most turquoise occurs as narrow seams in trachyte or granitic rocks (Smithsonian specimen).

Without stabilization, this eagle of Kingman turquoise could never have been carved (courtesy John Winston).

substances did when penetrating the porous stone.

Once Colbaugh saw the effect of the plastic, he realized it had possibilities for poor-quality turquoise, material that was normally too soft and too light a color. So, he experimented and successfully developed a stabilizing process that not only increased the supply of useful turquoise but, because the material could be sold at a reasonable price, opened a whole new world for budding artists who could not afford much higher-priced natural turquoise.

In 1962, Colbaugh moved to Kingman, Arizona, and began working the turquoise mine in Mineral Park. During excavation, he encountered abundant evidence of ancient Native American mining: stone hammers and collecting supplies that were later dated at 1,100 to 1,500 years old. The Mineral Park turquoise deposit was clearly one of the very earliest turquoise sites mined in the Southwest.

Turquoise was one of the earliest gems to be mined anywhere. It was found in archeological digs being worked in the Near East. These date to 5,500 years ago. The blue gem was so highly prized in Egypt that it has the honor of being one of the first gems ever to be imitated. The Egyptians developed a substitute using glass. The death mask of King Tut, for example, is inlaid with lovely blue stones, but they are not turquoise. They are what might be called turquoise simulants. The Egyptians called this blue material Vitruvius Caeruleum, which can be loosely translated as blue glass. We call this impure glass faience.

Faience is made using silica (probably derived from sand), a copper compound (usually malachite, but also azurite), calcium carbonate (calcite), and natron (sodium carbonate). This latter mineral was common in the dry desert and was one of the minerals used in mummification. When fired to the melting point, these ingredients combined to become an impure fused glass with a blue color. Faience actually reached a status similar to turquoise and was used for inlay, beads, and decorative items.

continued on next page

The term turquoise has its origins in Turkey, where it was called turceis. This translated to tourques in France, and then became turquoise in English (spelled with or without the final "e"). Prior to the arrival of the Spaniards in the New World, the blue copper gem was called chalchihuitl, a term used for other colored gems, as well.

Turquoise is found almost exclusively in or near copper deposits. It is fairly common when you consider it has been mined extensively in Persia, in several southwestern states, Mexico, Africa, Siberia, Australia, and China. China's current production of turquoise eclipses the total being produced by the rest of the world.

It is a secondary mineral, chemically a complex copper, aluminum phosphate that forms when the host rock, often trychyte or granite, weathers and releases the minaral apatite or another phosphate mineral, which breaks down and releases phosphate radicals. These combine with aluminum from the host rock, as well as water and the hydroxl radical, while picking up copper ions from whatever copper mineral is present to form a copper, aluminum, phosphate hydroxide hydrate. We call it turquoise.

The traditional thought on the formation of turquoise is expressed very well in R. Webster's superb volume *Gems: Their Sources, Descriptions and Identification.* As meteoric water works its way into the rock of the Earth, it picks up various ingredients like carbon dioxide and sulfur from organic material. On its journey, the water continues to gather impurities like phosphorous, either from the breakdown of minerals or from fossil remains. If copper is present in the rock, it, too, gets into the solution. Eventually, the mineral-rich solutions are concentrated enough for crystallization to commence, and while turquoise never forms visible crystals, with one exception, it does form in crystalline masses so fine-grained as to appear amorphous. The structure lends itself to being slightly porous, an important property to the processes of stabilizing or enhancing turquoise. The one occurrence of turquoise crystals is at Lynch's Station, Virginia, where it is found in microscopic crystals on dump rock.

Recent work on turquoise has suggested an unusual alternate theory of the cause of the blue color that is quite a departure from the standard evidence. Most researchers credit copper ions for the lovely robin's egg blue. This new idea suggests the color may be due to a complex amino-copper ion in the structure. It has even been suggested that animals may be the source of the organic phosphatic amino factor. That seems a little far-fetched to me, but who knows?

I was once involved in helping identifying a mineral of odd origin. It was a nice blue mineral thought to be a new copper species from one of Arizona's copper deposits. It didn't act like anything then known. Finally, it was shown to be a copper/mercury compound and the only explanation for the mercury appearing in that particular copper deposit was that it must have been residual mercury left from the decomposition of fulminate of mercury, the unstable chemical used in blasting caps. Hence, the blue mineral turned out to have human causes and was not a product of nature. If in fact some animal organic compound causes the blue color in turquoise, is it a valid mineral?

Turquoise is always porous and can range in hardness from a soft, unconsolidated powder to a solid Mohs 6. The harder natural material is excellent gem rough if it has enough color. The higher the copper content, it seems, the deeper the blue color. In the days before Colbaugh's monumental work, the very soft, or very pale material was discarded. Today, it is saved and is stabilized with plastics, which harden it and permanently help its color. Also, scrap and powdery turquoise are compressed into what is called "block," massive material that is mostly plastic but holds enough turquoise to be very useful in cheap jewelry. I wonder if Colbaugh ever envisioned that his curiosity and experiments would have such a profound effect on the turquoise market. He did live long enough to enjoy seeing his business reach its third generation and function under the heading Colbaugh Processing, Kingman, Arizona.

Before Colbaugh came along, when poorly colored turquoise was mined, it could only be treated in a couple of ways: rubbed with animal fat or buried in moist earth to absorb some moisture temporarily and darken. A quick way to get a darker color was to put the turquoise piece in your armpit and let nature do its work. Of course, this was a temporary effect, but it made possible a quick sale to the unsuspecting.

When the turquoise "craze" hit, it caused virtually every spot on Earth that had ever produced any blue at all to be attacked vigorously with heavy machinery. In some places, huge nuggets were found, some weighing in at over 100 pounds. Such huge pieces can only develop where there is space, at the juncture of natural cracks. These natural openings allow the accumulation of the turquoise-forming, mineral-rich solutions. Most turquoise, however, is found as thin crack-filling stringers in the natural rock.

Some of the most prolific mines were in New Mexico, Nevada, and Arizona. The big copper pits in Arizona produced a huge amount of turquoise as a byproduct. In fact, in some cases, subcontracting with the major mining companies allowed for the exclusive mining of turquoise, a common practice during the turquoise "boom." This produced huge quantities of turquoise, much of it of marginal quality, but thanks to treatment by Colbaugh and others, this marginal material became useful. Unfortunately, this created a problem because unscrupulous dealers would fail to reveal that treatment had been used and, in fact, might even issue a worthless certificate of authenticity in order to make a sale. Practices like this soured the turquoise market.

Prior to the craze, this material was bypassed, for the natural material mined was sufficient to satisfy the marketplace, which was dominated by mainly traditional Native American jewelry. That was soon to grow exponentially, and the demand for useful turquoise quickly exceeded the supply of natural, and that is what made the treatment of turquoise so important.

Turquoise is never quite pure. It always seems to have at least a trace of iron in it. This is understandable, as iron can easily replace atoms of aluminum in the turquoise structure. As the iron content rises, the color of turquoise moves from blue to green. Some folks prefer the green color. In Tibet, for example, green turquoise was more highly prized than the traditional blue. As the iron content continues to increase, the mineral changes from turquoise to chalcosiderite, an iron aluminum mineral. So turquoise's color ranges from a delightful sky blue through just about every shade of blue to blue-green to green.

The sky-blue stone, particularly the ancient material from the Ali-Mirsa-Kuh Mountains in Iran, can be a beautiful homogenous blue color. Most turquoise, however, contains stringers of white to gray to red, or black stringers of matrix, creating what is called spiderweb turquoise. Many artists prefer the spiderweb variety. The white matrix is the decomposed feldspar mineral kaolinite. If it is gray, the main constituent is glassy quartz. The red and yellow matrix lines are iron compounds, and the black can be iron or manganese compounds.

As we said, because turquoise is porous to varying degrees, the stabilization of turquoise is possible. The process sounds simple, but it takes weeks to stabilize a single piece of the blue stone. First, prolonged heating drives off all excess water. (An old pizza oven works great.) Then the turquoise is put in a sealed container filled with some form of plastic (usually an acrylic) and a fixer, and a reaction begins

continued on next page

between the two chemicals. This gives off great heat, and since the turquoise is in a closed container, pressure builds, which forces the curing plastic into the turquoise pores to a considerable depth. The result is turquoise that is hard enough to work into jewelry or carved into beautiful forms. One side benefit is a darkening of the natural color, making it an even more attractive blue.

Another technique in turquoise treatment is an electrochemical method, which is used to give poorly colored gem material a much better color while hardening it.

The industry is well aware of the confusion over turquoise terms related to treatment and synthesis, so it has developed a set of terms that should be used: natural, stabilized, enhanced, clearshot, colorshot, block, fracture sealed, and imitation. The first and last terms are self-explanatory. We have already described "stabilized," which has a related term, "clearshot." This means the stabilization process has not changed the color of the turquoise. "Colorshot" means some form of dye is infused into pale stones. "Enhanced" relates to colorshot, as it means color has been added. "Block" is made by compressing a mass of unconsolidated turquoise, loading it with plastic, and squeezing the entire mass into solid chunks that are then cut into manageable blocks. "Fracture sealed" is any turquoise that has been treated so its natural cracks are filled and sealed. Some treatments are really a combination of two or more of these practices.

It may be useful to know how to test for treated turquoise. A red-hot pin stuck into the suspected turquoise often results in the smell of burning plastic if it has been used as a stabilizer. Another test is to use a commercial liquid called Win-ox, obtained at any jeweler's supply store. A little Win-ox applied to turquoise that has been color enhanced will turn it white as the Win-ox attacks the blue dye.

It is universally agreed that natural turquoise that has never been treated and is suitable for jewelry use is approaching extinction. After all, turquoise occurs as a secondary mineral and is seldom found at extreme depths. In most cases, deposits seldom exceed 100 feet in depth, though Bisbee, famous for its great variety of copper minerals, produced some turquoise to depths of 1,000 feet. It is well known that desert ore bodies weather to great depths. But mining has long since gone far below the weathered zone of ore deposits where secondary minerals are most common, so the rich deposits of turquoise that once were, are no more!

Because the supply of fine, natural, hard turquoise has largely dried up, an accommodation among artists, jewelers and buyers has come about, so that stabilized turquoise has become the accepted norm. After all, it is only a practical result of the demand for turquoise in a diminished hard, natural supply. The exception to the diminishing supply picture is China. Amazing as it may seem, China is supplying fully half of all turquoise on the market today! Some of it is very hard and has fine color. The majority of the Chinese turquoise is somewhat soft, but still hard enough to use. It usually has an even softer black spiderweb matrix, which is quite attractive but can undercut easily. Many of the pieces I've handled would benefit from being stabilized. Still, it is encouraging that at least one source is still producing turquoise in huge quantities.

Natural 2-pound turquoise nuggets are prohibitively expensive (courtesy Carol Sues).

Today you can see turquoise used in a variety of jewelry creations. The basic form is the natural nugget jewelry mentioned earlier. It consists of rounded natural turquoise shapes strung as a necklace. It may be interspersed with red coral, shell, silver beads, or some other contrasting material, but the result is a piece of jewelry resembling the very earliest forms of Native American jewelry found in ancient burial sites. That earliest use of turquoise was very simple: rounding and drilling turquoise pieces so they could be strung or fastened to a garment.

The other end of the spectrum is the superbly crafted intarsia jewelry using a variety of gem materials, including turquoise, to create a scene in miniature. The patience and creativity of the artists who work these breathtaking works of art are much admired, and deservedly so. No wonder Native American jewelry art has reached stratospheric heights in popularity and is featured in galleries and museums.

In between the ancient and the ultra-modern are the more traditional uses of turquoise in jewelry. Each tribe in the Southwest developed a distinctive style of jewelry. The Navajos used more natural, uncut nuggets, mounted in silver bezels so that the oddly shaped turquoise pieces were held firmly in place.

The Zuni, on the other hand, developed a much more refined style using thin, rounded bits of turquoise laid in near-parallel form to create a very delicate style called pettipoint. Looking more like fine embroidery than stone inlay, the Zuni traditional jewelry has always been highly regarded. Lovely, radiating sunbursts of turquoise, sometimes as much as 3 inches across, form the basis of wide bracelets and lovely necklace pendants.

Today, both Navajo and Zuni artists start with the traditional styles, but vary them to suit their creative tastes. The large, radiating pettipoint of the Zuni has often given way to very small, more delicate forms. Nice V-shaped pendants incorporating other gems to offset the dominant blue turquoise are just one way modern Zuni artists have enlarged upon the traditional.

The same may be said for the Navajos, who have continued to use larger turquoise pieces, but now the turquoise is more often shaped and then contrasted by a complementary second gem like red coral, with the entire design set in silver and even gold.

Finally, the Hopis of Arizona did not use much turquoise. Instead, they developed a very lovely silver art form creating superb overlay buckles, bracelets and pendants. This is understandable when you realize the Hopi reservation is surrounded by the Navajo Nation, so early Hopi artists did not have easy access to sources of turquoise.

Turquoise for the early Navajo artists probably came mainly from New Mexico and the area round Aztec Peak, north of what is now Kingman. This is the source later worked by Colbaugh. The Zuni depended largely on ancient turquoise deposits uncovered in New Mexico and Colorado.

The Nevada deposits, some of which have produced some of the finest turquoise ever mined, were not known in the earliest times. Yet, when the turquoise craze hit, these deposits yielded some of the finest material found. Most are virtually mined out now.

It seems remarkable that a gem material that has been used for thousands of years still holds an honored place in the art of jewelry making. This is partly due to the lore and mysticism credited to the gem. The rest is due to the gem's usefulness and marvelous sky-blue color, available in price ranges that any artist can afford. Whether the gem is a gift from the gods remains a source of intense discussion. What we do know is it will be around for at least another 5,000 years, or as long as Mother Earth will yield this lovely blue treasure.

SHOP TALK

by William A. Kappele

Using Hallmarks

Recently, a reader contacted the magazine with a question about quality marks on jewelry she had made. She had heard that it was necessary to have some kind of license before she could apply the sterling quality mark. Well, since most of my jewelry is not marked, and that which is says "Made in Taiwan," I didn't know the answer, so I went digging.

It seems that gold and silver have been marked for purity for a long, long time. In the early 14th century, the English began marking precious metals with what they called a "hallmark" so that buyers could have some idea of what they were purchasing. The term originated with the Goldsmith's Hall of the Worshipful Company of Goldsmiths in London, where records are still kept of all British hallmarks.

The term hallmark has been used and misused around the world. The original intention was to indicate only the degree of purity of the piece. "Purity" also came to mean several things, including fineness, quality and karat. In some countries, however, the hallmark also came to include the identification of the maker, the place where the piece was assayed, the date of the assay, importation or exportation marks, and even taxes or fees.

In the United States, hallmarking refers only to the purity or karat value. Our laws came into being in the early 1900s, when Congress got into the act, probably because items were being sold with markings indicating that they were of a higher quality than they were. In their wisdom, our legislators passed the National Gold and Silver Stamping Act of 1906, which was signed into law by Theodore Roosevelt. Strangely enough, though, the act did not require that these metals be stamped for quality or purity, but only said that if they were, that the mark must be true.

It took 55 years before lawmakers discovered that an unscrupulous maker could stamp 14k on a bottle cap if he chose to and no one could trace him. In 1961, Congress amended the act to require that a registered trademark of the maker be stamped next to the hallmark. This made it possible to track down a maker who mismarked a piece. In 1976, the law was amended once again to tighten up the standards on rolled gold plate, gold plate, gold filled, silver plate, or gold or silver electroplate.

Well, this is all interesting, but just how does it affect the average hobbyist? I'm certainly not a lawyer, but my opinion is that it won't do much of anything. First of all, if you make jewelry for gifts, for sale, or for any reason, you are not required to stamp a hallmark on it. If you do stamp it, the law says that you must also stamp a federally registered trademark (maker's mark) on it. The idea, of course, is that if you misrepresent your work, you can be tracked down and prosecuted.

So why not just get the trademark and be done with it? you ask. Unfortunately, it can be a rather expensive proposition. If you do all of the legwork and paperwork yourself, you can get by for a few hundred dollars. If you use the services of an attorney who specializes in such things, it can run over $1,000. It is a dilemma. If you make a brooch for Aunt Freda and stamp the purity value on it, will the trademark cops knock down your door in the middle of the night and haul you off to a gulag? Probably not. Is it illegal? Yes. Should you ignore the law? I don't know, but if I start getting mail from prisons, I'll let you know.

For those of you who like to go right to the source, the National Gold and Silver Stamping Act can be found in U.S. Code Title 15, Chapter 8, Sections 291-300. If you would like to find out more on the subject without the legalese, try some of the folks listed below.

Jewelers' Vigilance Committee
25 W. 45th St., Suite 400
New York, NY 10036
www.jvclegal.org

Nolo Law Center
www.nolo.com/lawcenter/

The Federal Trade Commission
CRC-240
Washington, DC 20580
www.ftc.gov/

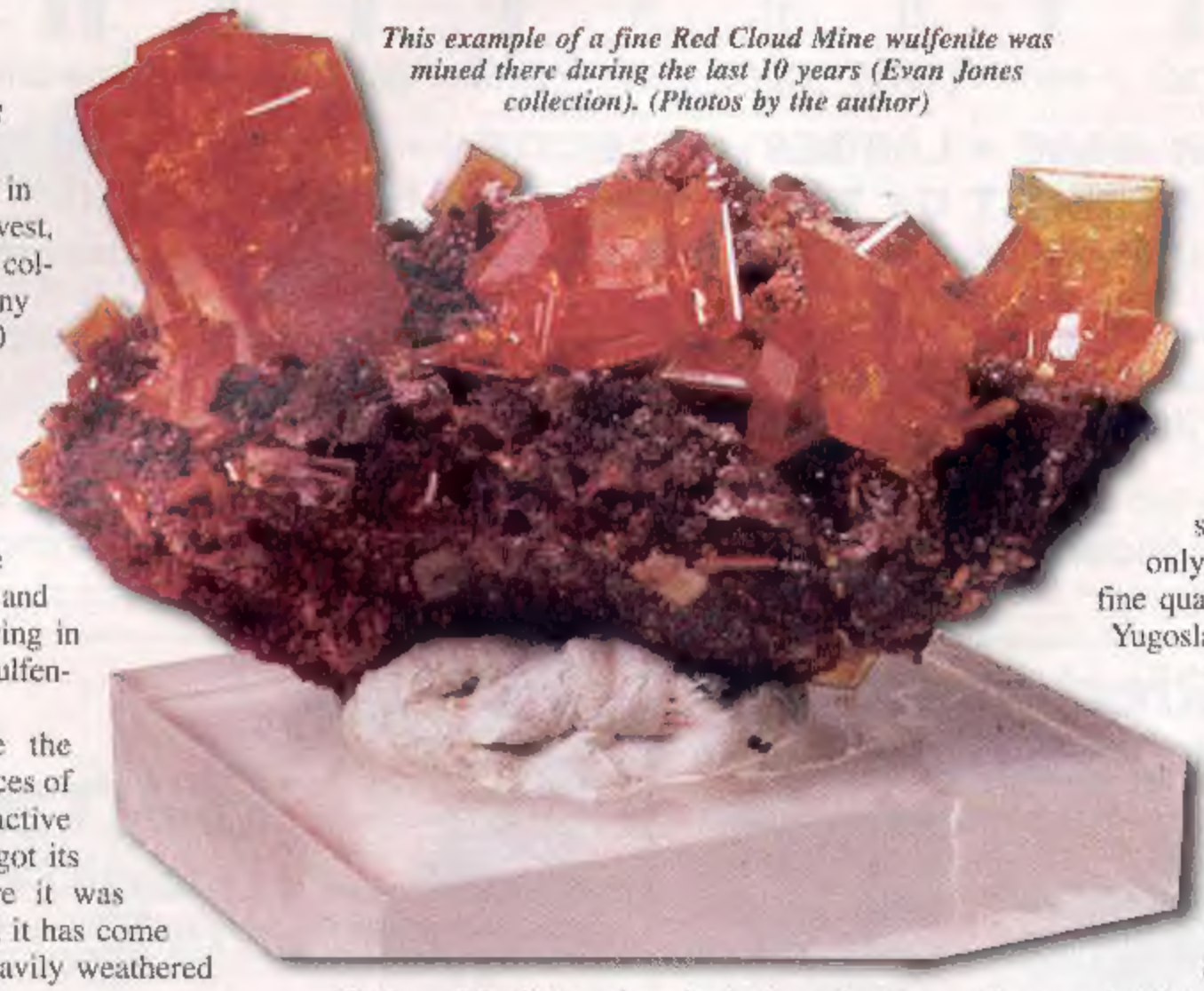
General Information Services Division
U.S. Patent and Trademark Office
Crystal Plaza 3, Room 2C02
Washington, DC 20231
www.uspto.gov/

Please feel free to contact me if you have a suggestion or comment about this or any of my Shop Talk columns. My e-mail is quappelle@cox.net, or write to me at 25231 Pericia Dr., Mission Viejo, CA 92691.

THE FRUGAL COLLECTOR

wulfenite

Beautiful Specimens Are Common



This example of a fine Red Cloud Mine wulfenite was mined there during the last 10 years (Evan Jones collection). (Photos by the author)

by Bob Jones

If you are a collector in the American Southwest, you have undoubtedly collected wulfenite at any one of well over 100 deposits. Add to that the Southwest's close proximity to Mexico, home of major wulfenite producers like the Erupcion Mine, the San Francisco Mine, and Mapimi, and you're living in what may be called a wulfenite collector's nirvana!

Arizona may have the greater number of sources of this delightfully attractive mineral but wulfenite got its start in Austria, where it was first found. Since then, it has come to light in a host of heavily weathered lead deposits.

It's the weathering, coupled with a desert environment, that created ideal conditions for huge quantities of wulfenite to form. In Arizona, for example, at least one mine used wulfenite as a major ore of lead and molybdenum. Weathering attacks surface deposits, slowly altering primary lead minerals (mainly galena) into secondary species. The deeper into the ground weathering can penetrate, bringing acidic waters from the surface, the more readily primary minerals are attacked and the greater the number, variety and abundance of secondary minerals that can form.

For wulfenite to develop, two ingredients are needed, along with that all-important atmospheric weathering and its oxygen. Those elements are lead and molybdenum. It so happens that many of the igneous rocks of the Southwest are formations that have been invaded by hydrothermal action bringing metals, including lead and molybdenum, from the Earth's interior. And nature does not respect political boundaries or borders, so Northern Mexico's mineralogical provinces are also rich in lead mines with accessory molybdenum.

Molybdenum is, in fact, a byproduct metal of the huge copper porphyries in the Southwest. So, with lead ions and molybdenum ions available, all it takes is the right conditions for a lead molybdate, wulfenite, to form. Except for molybdenite, wulfenite is the most common molybdenum mineral.

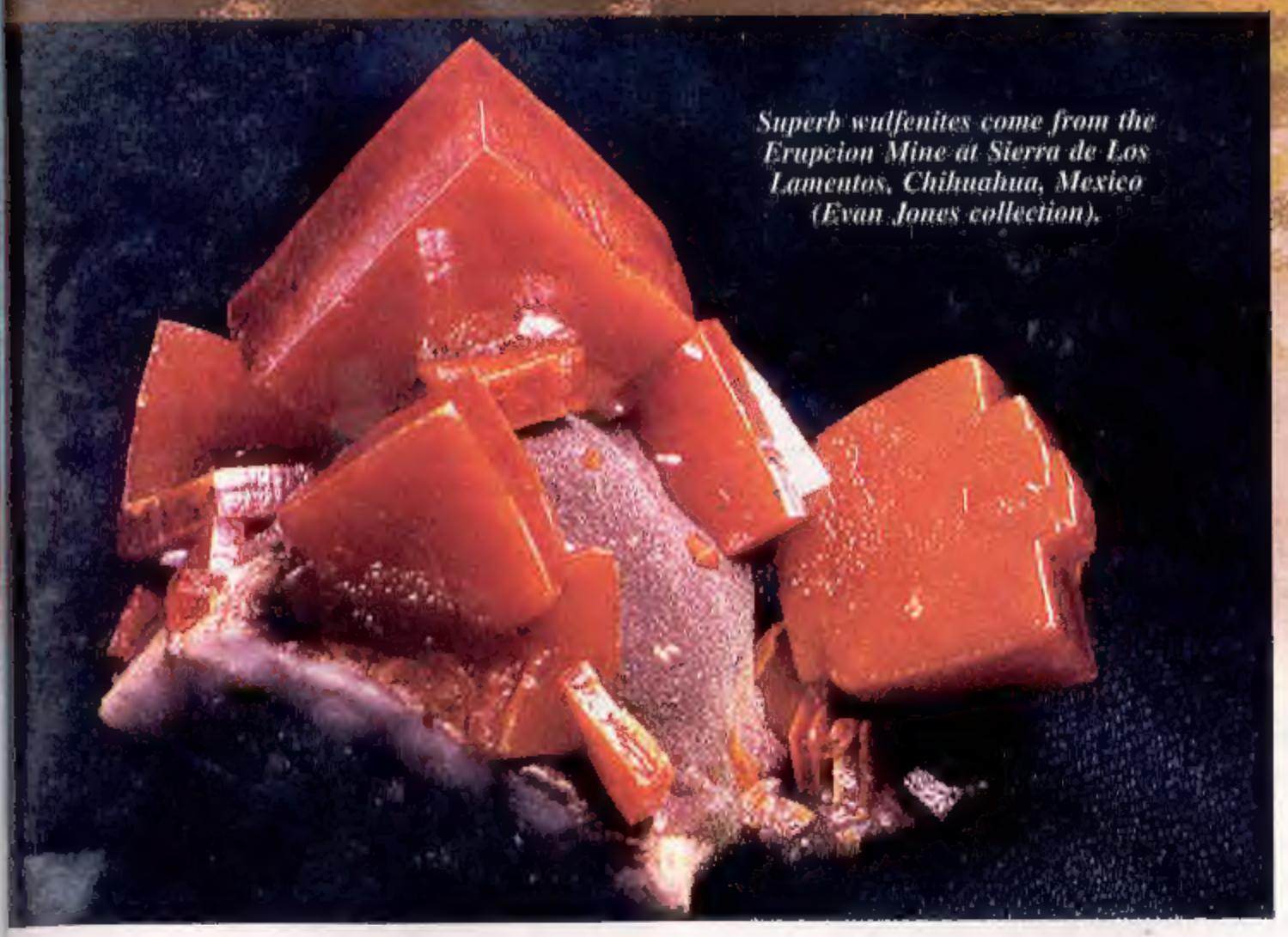
Molybdenum was finally identified as an element in 1791 by two different scientists, Scheele and Pete Heljm. Its most important use seems to be in making steel tougher. The earliest reports describing the lead molybdate wulfenite were about specimens from Bleiberg, Schwarzenbach, Carinthia, Austria. Here, lovely pale to strong yellow tetragonal crystals were found in abundance, typically tabular, often paper thin and transparent. The crystals are largely under an inch on an edge, but very attractive. The Austrian source has long since dried up, so specimens are seen only in museums and some private collections.

Wulfenite is named after the Austrian mineralogist, Franz Xavier von Wulfen, author of a 1785 paper on lead ores, including the wulfenite found in the Carinthian lead ores. Once recognized, wulfenite began showing up in a number of European localities—the German silver mines for one—but only found in quantity and fine quality at Bleiberg and Meis, Yugoslavia.

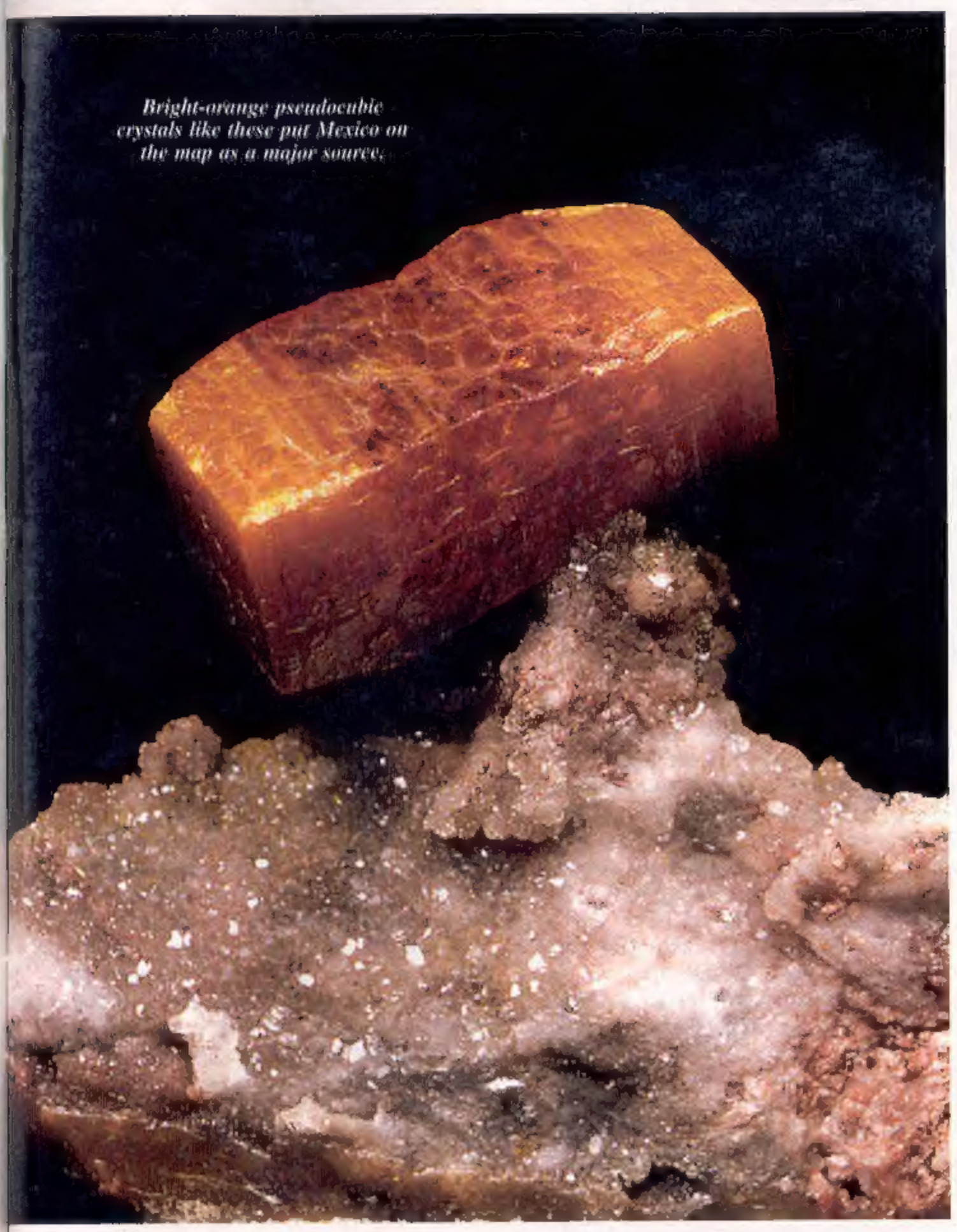
The Meis wulfenites are distinctly different from the thin yellow blades found at Bleiberg. They form in the tetragonal system, blocky, approaching pseudocubic form. When viewed from the side these crystals look somewhat like a sandwich in that a central zone or layer is a bit darker than the outer faces. The edges of the crystals tend to be slightly rough, as if incomplete. Crystals also develop a pyramidal habit both here and in several later-known localities.

The Meis crystals are a strong yellow with a hint of orange, especially in the darker zones. While the Bleiberg wulfenites tend to be somewhat scattered on matrix, the Mies specimens are large clusters of inch-high crystals attached at various angles to each other, like a bunch of caramel candies stuck together. Remarkably, though both these localities were worked a century or more ago, a specimen does appear at shows once in a while. These are from old collections or have been released from a museum.

Here in the United States, two Eastern localities produced wulfenite early on. One, a small lead mine in Loudville, Massachusetts, never yielded anything more than tiny crystals of yellow wulfenite in thin blades randomly scattered in tight



Superb wulfenites come from the Erupcion Mine at Sierra de Los Lamentos, Chihuahua, Mexico (Evan Jones collection).



Bright-orange pseudocubic crystals like these put Mexico on the map as a major source.

vugs. Minor amounts of pyromorphite-tiny, green, hexagonal crystals—were also seen scattered on matrix. Loudville specimens never attained anything more than casual or curious interest with local collectors.

The second Eastern source for wulfenite is much more famous and a more productive specimen mine. The Wheatley Mine in Phoenixville, Pennsylvania, was known as a source of lead as far back as the late 1600s, but serious mining didn't start until the middle of the 1800s. The mine is named for Charles Wheatley who started its development in 1850. Wheatley had already been involved in mining at the Bristol, Connecticut, copper mine, a major copper producer at the time. The Bristol mine was owned by the Sillimans, among others, all professors at Yale University. In the 1860s, after Wheatley had been so successful at his mine in Pennsylvania, he wrote to Silliman telling him he was going to take his proceeds from the sale of his lead mine—some $60,000—and go to California to strike it rich! The reason Wheatley was able to sell his mine in those days for an enormous sum was the richness of its ores and the superb mineral specimens it produced.

The Wheatley mineral suite is typical of a lead/silver deposit: superb green pyromorphite crystals coating rock, and large snow-white cerussite prisms to several inches. A second variety of cerussite, jackstraw cerussite, was also found in abundance. The queen of the Wheatley mineral suite is wulfenite in a variety of crystal forms and ranging in color from gray to fine yellow and even deep red. The remarkable thing about the Wheatley Mine is that its specimens are still seen at mineral shows well over 100 years after being mined. This is indicative of the abundance of specimens and the high regard for them. Wheatley specimens of both wulfenite and pyromorphite ranked, when they were being mined, as this country's finest examples of both species.

Among Phoenixville specimens, wulfenites were not as common or abundant as lovely green pyromorphites. Still, they occurred in wafer-thin blades to about ½ inch, transparent and yellow. More interesting are the very nice blocky crystals ranging in color from yellow to reddish orange to red. These crystals tend to be almost equidimensional, with flat terminations and slightly curving sides. Needless to say, these early wulfenite sources no longer produce, but an occasional specimen shows up for sale.

By the end of the 1800s, western lead/silver mines began producing wulfenites, among other attractive species. Eventually, something like 150 different deposits in a radius of perhaps 100 miles from the Tucson area yielded wulfenite. There is one mine, the Old Yuma, from which you can actually see the metropolitan Tucson area and the Interstate 10 artery that passes through the city.

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The Old Yuma gold mine has also produced superb vanadinites and sparkling orange wulfenites. While most crystals were found free-standing on matrix, once in a while a cluster of intergrown crystals was found. The mine is now federal land. The patented claim was sold to the government, for it borders the western portion of the Saguaro National Monument.

When the silver mines at Tombstone were discovered in the 1870s, one of the minerals miners considered unimportant was wulfenite. Superb orange-yellow blades, usually under ½ inch, transparent and wafer thin, in tight clusters, were found in a couple of the mines. Specimens came to light during the Depression, when miners worked the silver veins trying to make a living. They realized the wulfenite had some value, so they saved the specimens, which found their way into collections. More recently, rockhounds slipping underground in Tombstone have collected some nice specimens in past decades.

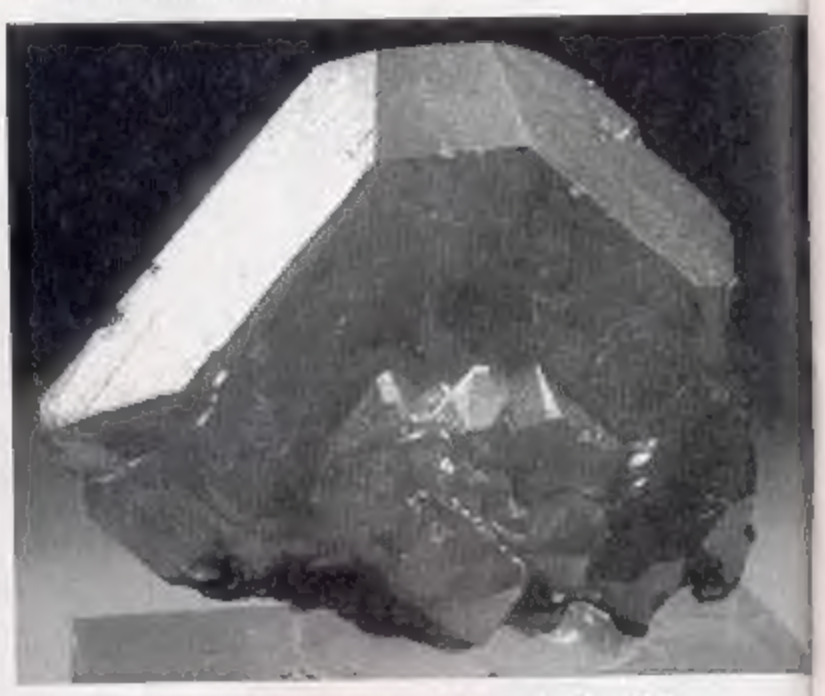
Another source of wulfenite that opened up in the late 1870s became one of the most famous of all wulfenite sources, the Red Cloud Mine, north of Yuma. Here, high-grade silver, mainly in the form of cerargyrite, caused considerable excitement. As mining commenced, the lead molybdate wulfenite was found near the surface in exceptional crystals: brilliant red, platy, tabular crystals ranging in size from a fraction of an inch to 2 inches on an edge. The exceptionally brilliant color and size of these crystals caused them to be saved, some of them ending up in the Harvard University collection.

Mining did extend underground at least 500 feet, but the better wulfenites were found very close to the surface on the main vein. In one exploration trip into the mine back in the 1970s, I found small, nearly black wulfenites to ¼ inch at the 500 level, but nothing to get too excited about.

The thing that really aroused interest in modern collecting at the mine was a strike made by Ed Over in the winter of 1937. At the time Ed was the collecting sidekick of Arthur Montgomery, mineralogy professor at Lafayette College. Ed was responsible for a number of major finds during his collecting career, among them the Fairfield, Utah, varscite nodules. But Ed's most famous find was a large find of brilliant red wulfenites at the Red Cloud—crystals the equal of which have never been found since. Crystals from his find have since been called "stop sign" wulfenites for their bright color and square shape with clipped corners.

In order to collect at the Red Cloud Ed had to get permission from the mine owners. He was told some contract miners were coyoting small silver pods in the underground workings. When he got to the mine, he realized these miners were a pretty rough bunch, but he proceeded anyway.

Ed went underground and scoped out the mine, going from tunnel to incline to stope, collecting minor wulfenites along the way. After a couple days of searching, he settled on one significant fracture and decided to open it up. After a couple of days of hand drilling and blasting, he was able to worm his way along the fracture, finding fairly nice wulfenites along the way. At one point, the fracture almost pinched out and he had to drill and blast again. When he shined his carbide lamp into the new opening, spectacular brilliant red wulfenite crystals to 2 inches were scattered about on a loose black dust that covered the pocket floor. All he had to do was scratch away at that rubble and, as he said later, "They came tumbling out into my hand!" He worked the pocket until it was exhausted of its treasure, all the time worrying about those contract miners up above. He knew they would try to confiscate his find if they learned about it.



The great specimen mine at Tsumeb, Namibia, is the source of this classic tabular wulfenite.

To avoid losing his red treasure, Ed put the single loose crystals and matrix pieces in the bottom of his carboard boxes and filled the boxes with as many low-quality wulfenite specimens as he could dig. Sure enough, when Ed came to grass, the miners demanded to see his find. When they saw the insignificance of what he had in the boxes they laughed and, with a few derisive comments, sent him on his way.

Ed shipped the wulfenites to his partner, Art, who skillfully marketed and traded the specimens to the major museums, collectors and dealers of the day. Today, you can see specimens of Ed's find in the Smithsonian, which acquired them when Art Montgomery's collection went to the museum.

The Red Cloud Mine has since been worked by specimen-mining groups, and with great success. They recovered hundreds of wonderful specimens of bright red matrix specimens—some of them plates a foot or more across and covered with brilliant red-orange crystals to an inch or more. That's why you can still see nice specimens of Red Cloud wulfenites from one of the world's most famous sources being offered for sale these days. The Frugal Collector can even add a bit of mineral history and wonderful color to a collection these days, thanks to mining at the Red Cloud the last two decades.

Small mining ventures that sprang up after the California gold rush opened up so many wulfenite sources. One of the more successful efforts is the Mammoth-St. Anthony mine at Tiger, Arizona. Developed in 1879 as a gold mine, it didn't take the mine operators long to realize they could also mine lead, molybdenum and copper. The Tiger wulfenites are very beautiful. Crystals can reach an inch or so. They occur mainly on matrix in wonderful clusters and huge, solid masses of crystals with no matrix, just solid masses of wulfenite crystals.

Another lead mine that was worked early on was the Glove, south of Tucson. Established in 1907 primarily for silver-bearing galena and other minerals, its production was sporadic. But in 1955, the main incline was extended in hopes of hitting pay ore. In October, a huge cavity lined with wulfenite was opened on the incline. Cave would be a better word for it. It measured about 10 feet by 6 feet, and about 4 feet high. I've been in that cavity and can only imagine what it must have looked like in 1955 when it was full of gorgeous, orangey/caramel-colored blades, some of them up to 4 inches on an edge. The crystals here are quite distinctive: flat, tabular, with no modifying faces save for corners that appear to have been clipped.

Another cavity some 35 feet long produced yet another huge batch of bladed specimens. In all, hundreds of boxes of choice wulfenites were mined at the Glove. And since that bonanza time period, individual collectors have mined again and again, so a vast amount of wulfenite has been recovered here.

Another Arizona mine, the Defiance, has also produced a vast amount of wulfenite, and its specimens are still seen on dealer shelves. The Defiance added immensely to the horde of wulfenite that is still on the market. Mining there exposed huge cavities seemingly filled with wulfenite, some of it as small, thin, yellow, tabular crystals. Best known, however, are the crystal groups that have a cockscomb arrangement of crystals: wedge-shaped tan blades, not particularly lustrous, but to over 2 inches in subparallel clusters of exceptional size.

One cavity was some 35 to 40 feet long and 12 feet wide, and was lined completely with good crystals. Hundreds and hundreds of pounds of fine specimens were collected here as specimen miners worked their way into the cavity. Before they finished, they had extended the workings well over 120 feet into the rock. No wonder Defiance Mine wulfenites are still available.

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Wulfenite *from page 23*

If Arizona was the only source for wulfenites, the mineral probably wouldn't qualify as something the Frugal Collector could afford. But, New Mexico has added some fine specimens, particularly from one mine in the Organ Mountains, which loom over Las Cruces. The Stevenson-Bennett Mine produced a considerable amount of specimen wulfenite not unlike the better material from the Glove Mine. Few of these are seen today, as the quantity never reached that of the several major Arizona mines.

Mining in Mexico has always been, and will continue to be, a way of life, so it is not surprising that Mexico joined the wulfenite production line decades ago—and did so big time. Mexico's most prolific wulfenite source is the Eruperon Mine, at Sierra de Los Lamentos, Villa Ahumada, Chihuahua. Actually, the Eruperon and its companion mines are some 45 kilometers from Villa Ahumada. That town is on Highway 45 south out of the El Paso/Ciudad Juarez area. From that small town, a road heads west, across the desert to the Los Lamentos Mountains. Most specimens you see now are simply labeled Los Lamentos.

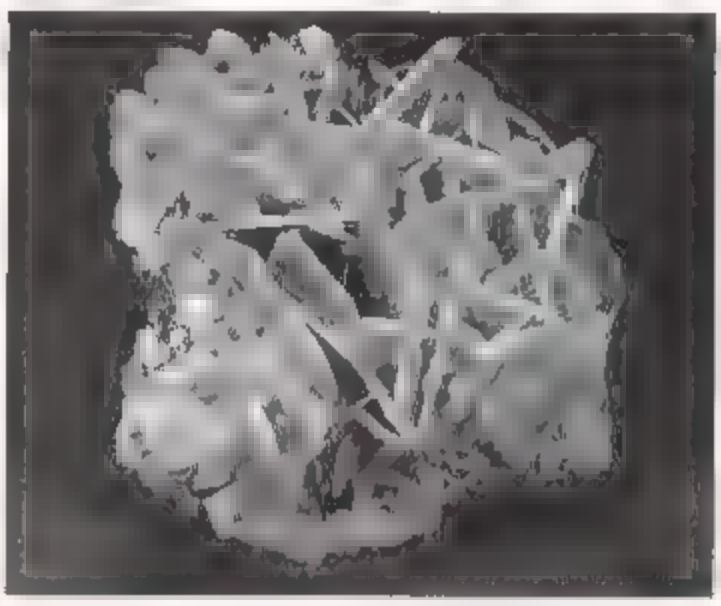
Los Lamentos wulfenite comes in a variety of forms. Some crystals are a nice wafer thin, transparent, simple tabular shape, well over an inch on an edge. Their color ranges from yellow to slightly orange yellow. Other crystals, also wonderfully transparent, are a paler yellow. The crystals that have put Mexico on the map as a major wulfenite source are the pseudocubic, bright orange crystals. Their blocky form makes them very sturdy, which many collectors prefer. They are also opaque. The larger crystals approach 2 inches on an edge and have a most unusual color pattern. The faces of the crystal are bright and lustrous and a fine orange color. Between the faces, the wulfenite exhibits zoning with a slightly darker color, sometimes the central color is dark enough to be a nice brown.

What makes these specimens exceedingly attractive, aside from the superb, thick, square crystals of lovely color, is that they rest on a snow-white layer of calcite (some call it onyx). Slightly sugary in appearance, this white calcite has an undulating botryoidal surface, which is the perfect background for the blocky orange wulfenites. Specimens a foot across were common at one point. I can recall being at the Tucson show some years ago when a huge shipment of these crystals, recently mined, was brought out from Mexico. Cabinet sized specimens tightly covered with blocky orange crystals were abundant. Others in this same load were a lustrous chocolate color, very lovely, but not as appealing as the bright-orange pseudo cubes. Still, they showed the same perfect, thick tabs in square cross section.

Still another type of Las Lamentos wulfenite is typically square and thick enough to be opaque. Interestingly, many of these dark-brown blades were crowned with tiny, lustrous brown vanadinite crystals. Just how much Los Lamentos material has come to light is hard to estimate, but it had to be thousands of pounds based on all I have seen through the years.

The famous specimen mine at Mapimi, Durango, is best known for its adamites. Huge quantities of lime green to blue-green adamites were found here for decades during silver mining. In later years, even superb violet adamites were found. Mapimi also produced huge amounts of hemimorphite, the rare mineral legrandite, and a large suite of other secondary species typical of a silver and lead deposit.

The Mapimi wulfenites never reached the quantity of these other minerals, but they came out in considerable numbers. They are easily recognized, as they do not exhibit the usual bright yellow to red color we associate with wulfenite. Rather, these crystals are a delicate yellow green and as thin as tissue. They were never found in large crystals, usually about inch at best. And they are always associated with tiny spherules of pretty lime green mimetite, a mineral often found in association with wulfenite.



A huge cavity filled with wulfenite at the Glove Mine, south of Tucson, produced some of Arizona's nicest specimens.

As nice as the Mapimi wulfenite/mimetite combination is, Mexico produced the same combination in specimens so magnificent as to compete with the best of the Red Cloud wulfenites. This wulfenite from the San Francisco Mine at Cucurpe (also listed as Cerro Prieto, Sonora) is a stunning red-orange color, with mimetite even redder in small, rounded spherules.

An old gold mine, the San Francisco Mine was riddled with fractures and open seams, which were sometimes lined with wulfenite. One fracture we checked was completely lined with dark yellow-brown -inch blades. The fracture was about ? feet wide, extended into the rock at least 4 feet, and ran vertically from one mine level to another a distance of over 100 feet. The fracture was so big that a person could actually get inside

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In this specimen from the rare species mine at Tiger, Arizona, orange wulfenite occurs with cerussite and dioptase.

me be completely surrounded by the wulfenite blades lining the walls. I know this because I watched my son Evan crawl right into that spot as he collected.

While these wulfenites were lovely, they paled by comparison with an earlier-discovered seam that produced those amazing bright orange-red blades up to 4 inches on an edge with even richer red mimetite balls to 1 inch. Sometimes, the mimetite was perched on the edges of the tabular wulfenite. Other specimens exhibited embedded mimetite, some of which extended through the lead molybdate blades.

The better San Francisco Mine wulfenites are amazing. They are water-thin, a brilliant yellow-orange to orange-red, occurring in heavy subparallel clusters with virtually no matrix. Breathtaking specimens of this material set the wulfenite world on fire. Flat after flat came out of one pocket and triggered more and more efforts to find wulfenite here. A later pocket produced choice thin, opaque yellow crystals in large clusters. This pocket triggered one of the more exciting adventures in Sonoran Mexico.

At the time, I was on the Board of Directors of the Arizona Sonora Desert Museum. The museum had an arrangement with the miners to be contacted if a good pocket of wulfenites was found at the San Francisco Mine. As a writer, and being associated with the museum, I wanted to be part of whatever team went to see a pocket. I wanted to photograph a wulfenite pocket in place, mine it out, and replicate it at the museum.

My friend Jeff Kurtzeman, a superb photographer, was asked to go to the mine and photograph whatever pocket might be opened. When we got the call, Evan, Jeff, ASDM curator Bill Panczner, and I made the mad dash to Mexico. We rendezvoused with Jos, the miner, and drove into the property. As it turned out, the pocket we were invited to see was the yellow-brown wulfenite pocket earlier described. It was judged not suitable for the museum. Luckily, at a later time, a good pocket of fine yellow blades came to light and is now in the Arizona Sonora Desert Museum.

Most collectors agree that the "stop sign" wulfenites from the Red Cloud Mine are the best ever collected (Evan Jones collection).

Though there are dozens of Arizona mines I haven't described, only one other produced a quantity of superb wulfenites, the Rowley. Located about 10 miles west of Gila Bend, the Rowley is a huge barite intrusion with fractures lined with choice small orange wulfenites. Thin as paper, these lovely blades never exceeded ½ inch. Perched on bright white barite, they make wonderful display specimens.

Every trip I made into this mine was a good one. You could look up into cracks in the ceiling and see blade after blade after blade in nice clusters, just waiting to be plucked from the opening. We never left that mine empty-handed. The mine is still accessible, though dangerous enough that I will not return, thanks to thoughtless damage done in the search for wulfenite. Yet, the number of specimens from here is enormous enough that you'll still see them for sale at shows.

Several foreign localities of recent vintage have also produced wulfenite. Tsumeb, Namibia, has produced crystals that exceed 2 inches on an edge. They are seldom of bright color, usually a dull yellowish brown, but a few fine yellow clusters have been rescued here.

Morrocco is a better source for nice wulfenite. Mibladen was one of the earlier sources of lovely yellow blades in tight clusters. Some of its specimens exhibited fine yellow blades scattered on matrix. Another source in Morocco is Touissit, famous for a nice variety of lead minerals, vanadinite and wulfenite among them. Again, superb yellow blades, opaque but very attractive, to an inch or more have been mined here. For complex pyramidal crystals, Ouja has been the source. Its specimens appear irregularly, depending in part of the rise and fall of the water table. A second variety of Ouja wulfenite is ½-inch blades of a strong orange color. The better pieces have wulfenite scattered over a white barite matrix, with some of the barite nicely bladed in contrast to the thin tabular wulfenites.

China, a country that has suddenly become a major specimen producer, has started marketing wulfenite from Guansu Province. These are thick, tabular, dark red crystals. How much wulfenite shows up in the future will determine their availability to the Frugal Collector.

For anyone looking for good wulfenites to add to a Frugal Collector's display cabinet, the best place to go is the Tucson Gem & Mineral Show. The show attracts local collectors who either set up a booth or bring goods they have collected to trade with dealers at the show. A number of small mines in Southern Arizona still produce the occasional wulfenite I have yet to go to that show and not see dozens of wulfenites ranging in price from under $50 to several thousands.

If you can't make it to the Tucson Show, check any western dealer's stock when you go to a show near where you live. At last year's annual show in Columbus, Ohio, to be held again the last weekend in March 2004, I saw several wulfenites priced just right for the Frugal Collector. All it takes is knowledge and careful searching to put together a nice suite of this colorful lead molybdate.

The Glove Mine wulfenites are quite distinctive: flat, tabular crystals with no modifying faces except corners that appear to have been clipped (Evan Jones collection).

LAPIDARY LORE and MORE

by June Culp Zeitner

History of the Main Show, Tucson, Arizona

Albert and I were staying in Mesa, Arizona, for the winter of 1957. Friends from Tucson invited us to spend a weekend with them so they could take us to the Tucson Gem & Mineral Society show. We had seen a couple of the AFMS shows in the early 1950s and found them exciting and interesting. We had also attended a Rocky Mountain Federation show in Rawlins, Wyoming, so our expectations of "just another club show" were not high, but we did want to visit with old friends from Chicago's ESCONI.

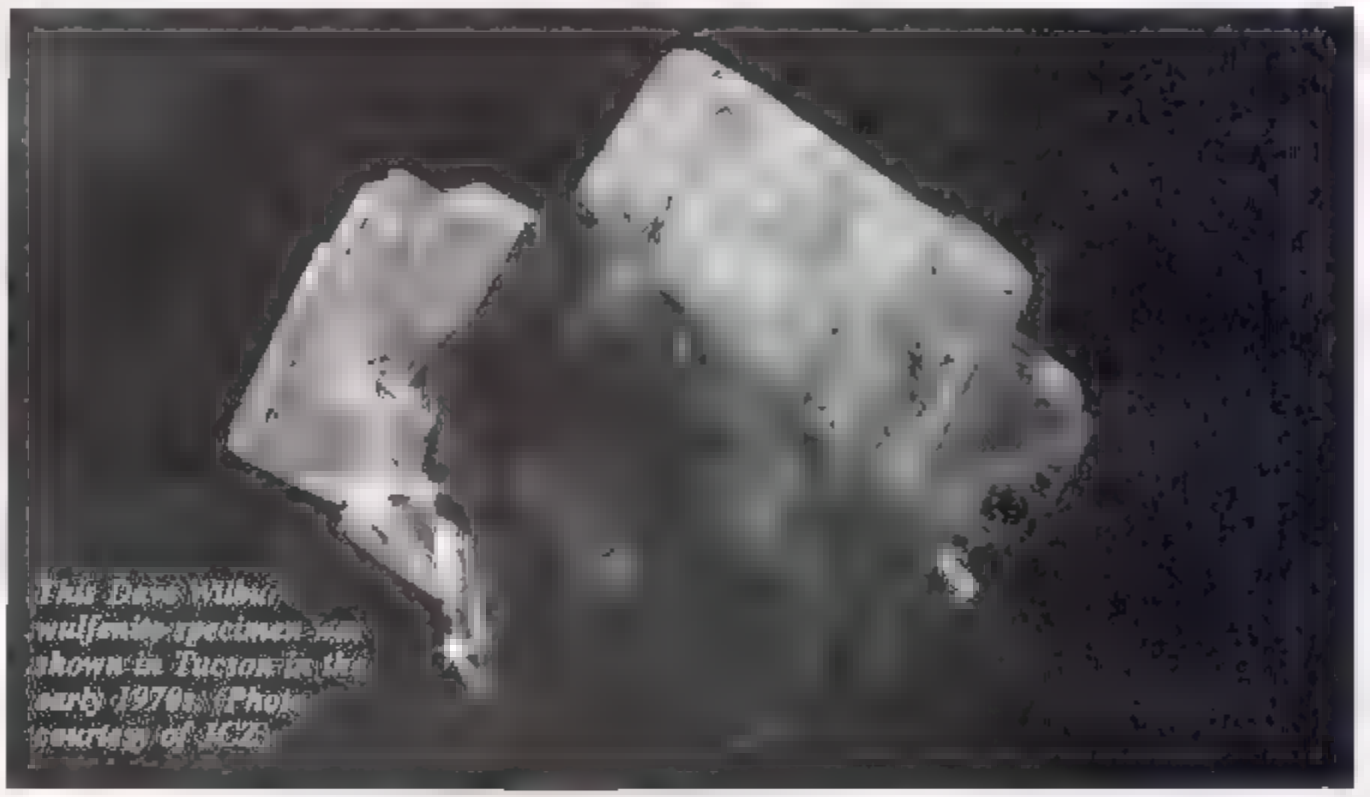
Were we surprised and delighted! We spent a magic weekend at the show from opening to closing each day. My first book had been out for a year and I had been writing for the *Mineralogist* and *Lapidary Journal* so I enjoyed meeting some other writers and people they had written about. The displays were excellent, some were amazing. Everything was well organized and well arranged. We met some dealers with such high quality and affordable specimens and supplies that when we returned to Mesa, we were both wondering where we were going to store everything until spring. We also resolved to return to this remarkable show the next year, and the next, and ever after—as long as we were able.

I was asked to speak at one of the early fairground shows. I don't remember what I talked about, but I do recall the noise of lapidary equipment and the smell of hamburgers and onions on the other side of the curtain that separated the program area from the demonstrations and the food concession. The next year, I was again a speaker. Paul Desautels and I walked about 200 yards up a dusty highway to a large building that was the new program site.

The show had innovative competitions, using members' ideas of "rules and awards" long before the official AFMS Uniform Rules were first used in Des Moines in 1962. In addition to the early mineral marvels there was some great lapidary work featured in Tucson, such as the O.C. Barnes 63-piece onyx dinnerware set and Olive Cochran's carvings and intarsias.

Some of my most pleasant Tucson memories are David Weber's magnificent minerals, the egrandite "sun," Betty Robert's Blue Capped Tourmaline reunion, the silver "forest" from Kongsburg, Norway, some vibrant proustites from the '79 silver anniversary, John Medici's big, shiny Herkimer quartz crystals, the Van Pelt lapidary work, and the Proctor, Wilbur, Barlow, and Romero minerals. I've only missed six shows since 1957.

Other favorite exhibits were from the unprecedented numbers of great museums sending their finest minerals, and often people. In addition to the important American museums of natural history—New York, Cleveland, Pittsburgh, Cincinnati, Boston, Los Angeles County, Denver, Houghton, Michigan, and Tucson—there have always been prestigious foreign museums like the Norwegian Mining Museum, the Sorbonne of France, and the National Museum of China. Our own national museum of natural history, the Smithsonian, has often been the star. America's famous museum of lapidary arts, the Lizzadro, has represented gem cutters of the world.



This Dave Weber meteorite specimen was shown in Tucson in the early 1970s. (Photo courtesy of AGS.)

Having been a teacher early in my career, I have always been trying to attract young people to the wonders of the mineral kingdom, so I was fascinated one year to see the exceptional displays by the Junior Explorers, sponsored by the Tucson Club. Some of the Juniors became well-known mineralogists. Two of them are Gene Schlepp and Richard Bideaux.

It has been rewarding to have the chance to get acquainted with gem and mineral enthusiasts from other countries. There have been large groups from Australia and Germany, as well as smaller groups and individuals from South America, Italy, France, Japan, and Israel. When Pansy Kraus and I had the *Lapidary Journal* table to sell subscriptions, foreigners often bought multiple-year subscriptions. I can't forget when an enthusiastic dealer from Namibia came to our desk to renew. He introduced himself this way: "My name is Sid Peters. I discovered pietersite. Here's a sample." (He died this year.) Alaska's prominent Ora Stewart of the Stewart Jade Mine and the Chugach Gem & Mineral Society made Tucson a stop on some of the international rockhound trips she led.

It is always interesting to learn who won some of the special trophies and fun to examine the entries in advance and make sometimes accurate guesses about the judges' final decisions. The Lidstrom Trophy is for the best of any species. There is the Romero award for the best Mexican specimen. The legendary McDole trophy for "best rocks" includes a swig of some over-aged libation that is said to prevent any long thank you speeches.

Lectures and symposiums are always interesting and well attended. Sy and Ann Frazier's "Meet the Author" events have been greatly rewarding, although there is so much going on during show week that sometimes more authors showed up than listeners, but what a great opportunity for those of us who feel compelled to write about gems, rocks, minerals, and fossils to become acquainted. The lobby has representatives of many groups affiliated with our interests—among them the American Land Access Association, various geological surveys, the Forest Service, and children's museums—ready to answer any questions, from "Where's the bathroom?" to "Why is the government trying to close off our rock hunting areas?"

The lobby is elegantly adorned with brilliant mineral posters of the chosen annual theme. Themes have been either a mineral species or a group of minerals found in a certain mineral-rich area, such as the Andes or Mexico. For the 2004 50th anniversary, the

theme is gold. I can't wait to see some of the most magnificent specimens ever found.

Sometimes my favorite minerals were theme species and sometimes not. The Sweet Home rhodochrosites were truly sensational in 1993, and Norwegian silver dominated in 1979. Art Grant's big, diamondlike faceted calcites were showstoppers for the calcite theme of 1996. But many non-theme minerals are also sharply engraved in my memory. The huge fluorescent "tunnel" looked like a gallery of modern art. Any of the specimens of Barlow, Wilber or Proctor got and held my attention.

I remember an exceptional specimen of rose quartz crystals from Brazil, a barite from Congo, a euclase from Colombia, pyrite from Peru, emeralds from North Carolina, and sapphires from Montana. One year, maybe in the 1980s, there was an unforgettable assembly of some of the world's top crystals pictured in Peter Bancroft's book *The World's Finest Minerals and Crystals*.

In recent years, the addition of magazine publishers in our fields of interest has been well received. Enthusiasts can visit with the editors and get subscriptions to the pioneer earth science magazine *Rocks and Minerals*, the first lapidary magazine, the *Lapidary Journal*, an excellent new magazine, *Matrix*, dedicated to the history of well-known localities and people, or the new rockhound favorite, *Rock & Gem*.

The auction for the *Mineralogical Record* is an annual event creating much excitement. Friends of Mineralogy affiliated with *Mineralogical Record* has added to the scientific importance of the Tucson Main Show.

Of equal importance to the splendor of the displays and the thrill of great occasions such as the Faberge opening reception is the family reunion aspect of the TGMS show. Where else could long time show addicts greet old friends, make new friends, and meet people they have admired in gem and mineral land, like those who have made these occasions so memorable to me? Some that I think of as I write are Paul Desautels, Olive Colhour, Hugh Leiper, Neal Yedlin, Russ MacFall, Gerhard Becker, Kirby Silber, Sy and Ann Frazier, Brad Cross, Richard Norton, Harold and Erica Van Pelt, the Hazings, Bob Jones, John Barlow, the Vargases, the Muttons, David Wilber, Peter Bancroft, Paul Downing, Joel Arem, Fred Pough, and John Sinkankas, but if I were writing this yesterday or tomorrow, the list could differ a little.

There is no way the Tucson experience can be summed up in a few hundred words or a few pages. Maybe not even an encyclopedia could completely cover the amazing 50 years. It's our international convention, our Aladdin's cave, our bonanza mine, our show of shows. Congratulations and happy 50th anniversary to the Tucson Gem & Mineral Society's Main Show!

BUILD A LAPIDARY COMBO UNIT

Get Started in Lapidary for Less

by Jerry Monfort

One of the biggest obstacles facing the aspiring lapidary is the price of lapidary tools. Many young (or old) rockhounds would love to experience the joy of polishing their own small geodes and cabochons, but are limited by their budgets. A basic combo lapidary unit for sanding and polishing a stone can sell for well over $1,000. It's not easy for most people to spend that kind of money for a recreational tool. As one of those who could not easily justify spending large amounts of money for a hobby, I decided to look for alternative methods of achieving my lapidary goals.

One of my earliest observations was that most of the world's jewelry and cut stones come from poor or under-developed countries like India, Thailand, Indonesia, China, and Mexico. Surely these folks cannot afford to spend large amounts of money on their tools. And people have been cutting stones and making jewelry for thousands of years, long before electricity and motors, not to mention long before the marketing of thousand-dollar combo lapidary units.

Another thing I discovered by talking to the old-timers in the lapidary business is that in the "old days," most rockhounds would make their own tools or would buy homemade tools. It seems that most of the commercial lapidary equipment sold before the '60s was made in someone's garage or cellar. I've seen old lapidary units made out of plywood, 2x4s and washing machine motors. After all, the mechanics of the job are pretty simple. You need to be able to sand a stone with progressively finer grits until it can be buffed to a polish.

The way the expensive lapidary combo units deal with this is to have several wheels of various grits—diamond, sandpaper, or silicon carbide—with a flat polishing lap at the end. This is a very convenient setup, it allows you to start at one end of the machine with a roughed-out stone, and work your way, step by step, to the other end of the machine to polish your stone on the lap. The machine I'm going to describe here is not quite so convenient. It requires you to change the sandpaper (or lap) between each step. Of course, this is going to add a few minutes to each step, but if you balance that against the several hundred dollars you will be saving, I think you will agree that this is a great option.

Before we start, let me say a few words about safety. This power lapidary tool is potentially dangerous. Coarse-grit sandpaper can grind off knuckles so fast it will surprise you, and fine grit sandpaper can polish your skin down to a paper thin layer that you won't feel until it starts to bleed. A stone being polished can fly off the lap with the velocity of a bullet, so wear safety glasses. Electricity can kill! If you are going to be using this machine with water feed, make sure you use a Ground Fault Circuit Interrupter (GFCI) on your electric supply. This will cut off the electric current if the motor gets wet and shorts out. Be careful! If you aren't 100 percent sure about what you are doing, *stop* and find some help. Neither I nor *Rock & Gem* magazine will be responsible for anything you do with the information in this article.

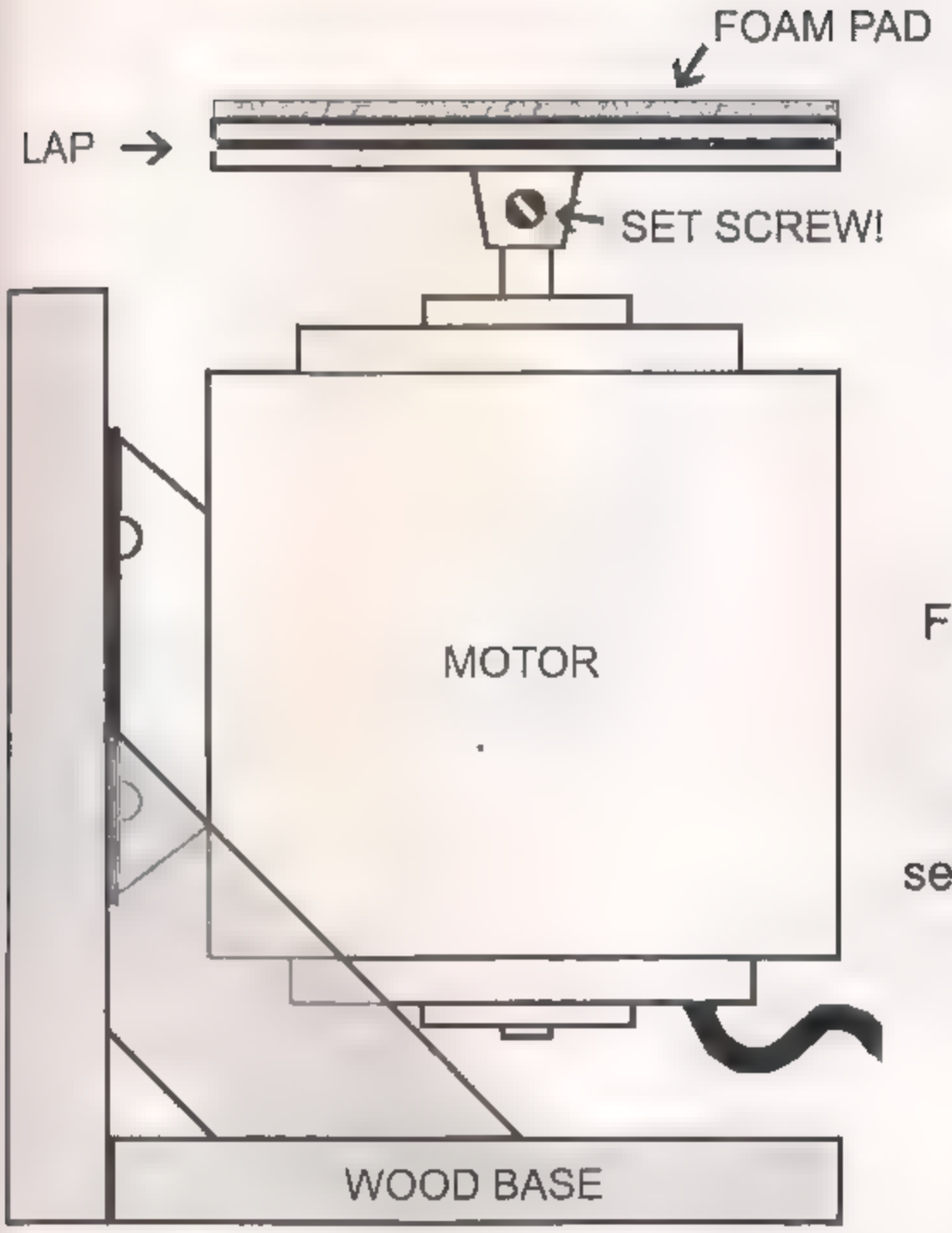
The Parts

This is just a guide to building your own lapidary sanding and polishing tool. Do not feel locked into using the exact items I've used. To save money, use salvaged parts. In the past, I've build tools from motors taken out of everything from vacuum cleaners to bench grinders. I bought the motor for this project at a yard sale for $15—a lucky find! It came out of a small (broken) band saw. The wood was left over from other projects, and was already cut to the size it is. It can be larger or smaller, as long as it's strong enough to support the motor securely.

For this project, you will need wood, corner braces, a motor, a lap, foam pads, sandpaper discs, a leather or canvas polishing disc, and polishing compound.

The general plan is this: We will mount a motor on a stand made of wood, and then we will attach a lap to the motor. The wood can be either plywood or solid wood. It should be at least ¾ inch thick by approximately 10 to 12 inches across. The length will depend on the configuration you want to build. It could be anywhere from 18 inches to 4 feet in length. The approximate cost of the solid wood, if store bought, is $10. Corner braces can be bought at a hardware store, or can be made from two pieces of wood for approximately $5.

This whole machine is built around the motor, so take your time and try to find a good one. Although almost any motor can be made to work with a bit of rigging, some motors are better suited than others. For this application, I like motors that turn at 1,720 rpm. There are motors that turn at 3500 rpm, but that is too fast for this application. It makes it difficult to hang on to your piece while you're working. Look for a motor that has built-on or attached mounting hardware. This will save you from the prob-



A Basic Lapidary Machine
(Photos and illustrations by the author)

leans of trying to figure out how to attach the motor to the wood Also, consider the horsepower size of the motor The motor I used for this project is a 115-volt, ¾ horsepower motor, and it has all the power I need I'm sure anything over ½ horsepower and below 1 horsepower would work fine If you can find a motor with the electric cord already attached all the better If not, there is usually a wiring guide somewhere near the connections If you can't find a wiring guide, don't buy the motor.

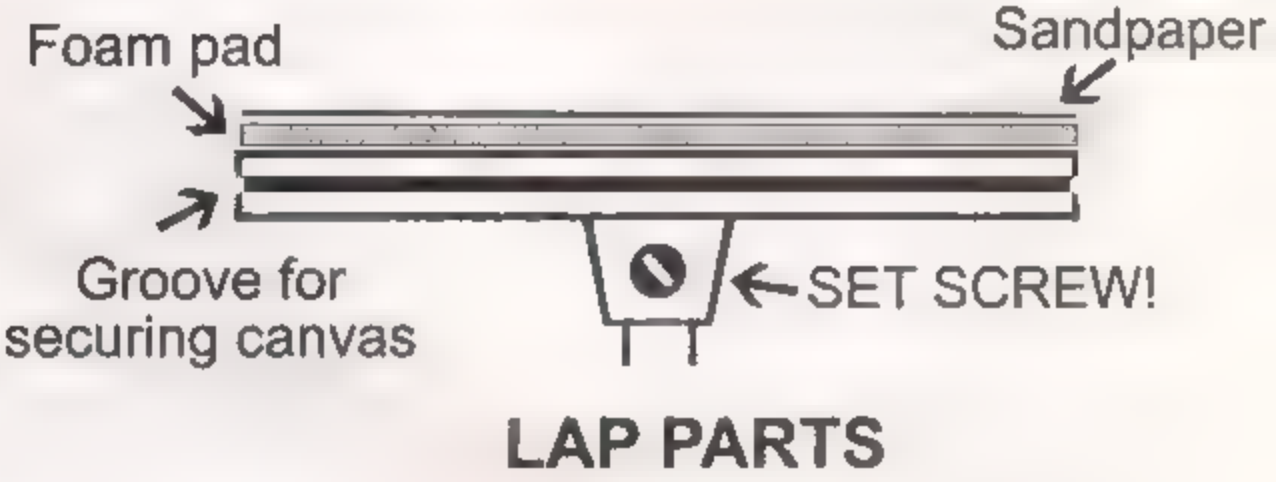
In Phoenix, there is a large freight store that specializes in super cheap foreign tools The tools for the most part are junk, but I have found this store to be a great source for motors. I recently purchased a ½ horsepower bench grinder on sale for $28! I threw the wire brush and grinding wheel away, and I had a perfectly good motor with a stand built onto it for less than $30

You will most likely have to buy the lap at a lapidary supply store They cost anywhere from $15 to $30. A lap is a flat disc with an attachment on one side to secure it to the shaft of the motor, and a groove around the edge to which to secure a canvas or denim polishing cloth

Laps are made to accommodate several different shaft diameters, and with several different overall diameters Make sure that the shaft diameter of your motor and the corresponding hole in the lap are the same size The overall diameter of the lap I'm using is 6 inches

I like to use a foam or felt pad under the sandpaper It helps prevent hard, flat spots on your stones You can get them at the lapidary supply store, they come in the same sizes as the lap Attach them to the lap using rubber cement or a spray adhesive. If you intend to use separate laps for each step, you will need a pad for each lap. They cost less than $5 each.

When shaping a stone, you go from very coarse grit to a very fine grit sandpaper All sandpaper is numbered according to the size of the grit. The numbers get higher as the grit gets finer, 100 grit sandpaper is approximately twice as aggressive as 220 grit The sandpaper can be purchased at any lapidary supply store to match the size of the lap you are going to use Some sandpaper discs come with a self-adhesive backing that will hold the paper very tight I prefer to use spray adhesive that is not permanent This allows me to change the sandpaper easily Silicon carbide sandpaper costs about $2 to $3 per sheet



LAP PARTS

It seems like everyone I talk to has a different idea of what's the best all-around polishing compound Some say you should use cerium oxide, some say tin oxide, while others expound on the power of diamond powder I like to use Tripoli powder It is probably the least expensive of all the polishing compounds, and seems to work well on most stones. As funds become available and as you gain experience, you should experiment with different polishing compounds to experience the attributes of each type Most common polishing compounds cost less than $10

After you have shaped and sanded your stone to a satin finish with no visible scratches, you polish the stone on a lap that has a leather or canvas cover over a foam or felt pad The leather pads are normally glued to the lap in the same way as the sandpaper If you are using canvas (I use a cut up pair of jeans), they are attached to the lap over a felt or foam pad with a wire around the edge of the lap These covers cost about $3 to $5 each.

Building the Tool

1. A little extra thought at the beginning goes a long way to making this a useful tool Take a little time to think about how you would like the tool to be mounted on its base Usually, the base is clamped with a large C-clamp to a workbench Depending on how and where you want to use the tool, you may want to modify the design to suit your needs I mounted the motor on my tool with the lap at the top of the machine This allows for an easy view of the work surface The disadvantage to this design is that if you want to work your stone wet, it is very easy for water to drip down into the motor. This is not good for you or the life of the motor If you are only going to spritz a little water from a spray bottle onto the lap, you could devise a water shield by making a hole in a plastic plate that will fit over the shaft of the motor and under the lap, and use silicone glue to attach it to the top of the motor. This will prevent most water and debris from getting down into the motor

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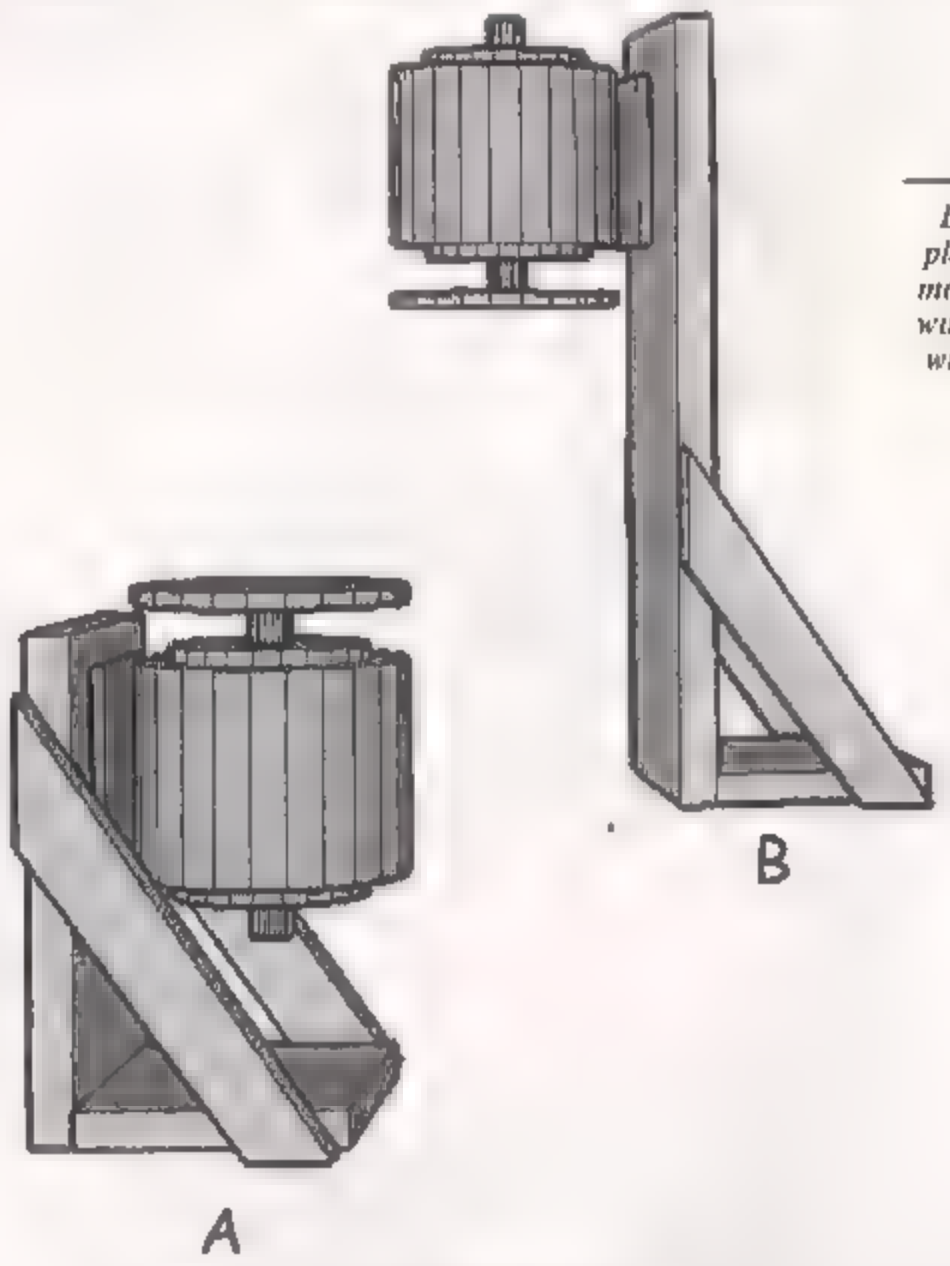
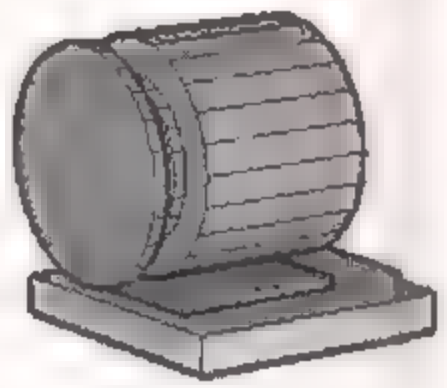


Depending on how you plan to use your unit, the motor can be mounted (A) with the lap facing up, (B) with the lap facing down, or (C) on its side.



If you want to work your stones really wet, it would be just as easy to have the motor mounted lap down. This would make it easier to feed water to the lap from below without it getting into the motor. I like to use drip irrigation fittings to supply water to my tools. They are very easy to work with, and require no special tools. Don't forget to consider the water runoff. It's relatively easy to mount a splashguard made from sheet metal or an old plastic tub lid to the tool behind the motor.

If you are going to be using the tool with water, don't forget to protect the wood from the water. It does not take long for water to ruin a tool. The water causes the wood to swell, and then it shrinks as it dries out. Soon, the screws and nails start to come loose, and all your work was for nothing. A little paint or water seal will prevent absorption of the water and make your tool last a long time.

2. If you found a motor with built on mounting hardware, it pays off when you attach the motor to the board. All you need to do is set the motor on the wood where you would like it, mark the holes where you need them, and drill them out. I like to use bolts with washers and nuts on the backside of the tool. This makes it very easy to tighten the motor if it works itself loose.

If you did not find a motor with mounting hardware built on, you will have to concoct some other method of securing the motor to the board. One possible solution is to sit the motor between two wood rails, then strap the motor down with metal hardware tape or very large hose clamps. The most important thing is that the motor be held securely in place. There should be no wiggle! Any wiggle will only get worse as you use the tool.

3. To attach a lap to a motor, put the shaft of the motor in the hole on the backside of the lap. This sounds easy, but there is a lot to consider. If you are using a lap that just slips onto the shaft of the motor, there is often a hex set screw that needs to be tightened to secure the lap. Make sure you tighten this screw. If there is a flat spot on the side of the motor shaft, make sure the screw is over this area before you tighten it. It will keep the lap from spinning on the shaft. Otherwise, just make sure the screw is secure.

If you are using a lap that has a threaded receiver, there are several things to consider. Make sure the threads match and the motor spins in the correct direction. There are clockwise, and counterclockwise threads. Depending on which way your motor turns, the threads should be oriented to tighten as the motor spins. If you wired the motor yourself, make sure you wired it to spin in the correct direction. Otherwise, when you turn on the tool, the lap could launch off like a Frisbee from hell. Also, you want to use a lock nut on the shaft to tighten against the lap. Otherwise, the lap could fly off when you turn off the tool.

Whichever type of lap you use, make sure it fits snugly. Before you tighten the screw or locknut, try to wiggle the lap. If there is excessive wiggle, you may have bought the wrong size. The difference between ⅛ inch and ¼ inch or ¼ inch and ⅜ inch is only ⅛ inch. It is easy to make a mistake. There is a lot of room for slop and improvisation in the project, but this is not the place for it. If the lap does not fit well, no matter how tight you tighten the set screw, it will never stay tight. When a lap spinning at 1,700+ rpm with 80 grit sandpaper attached separates from the motor, it's not good.

Be careful with motors that have a smaller diameter shaft. The leverage created by the lap is sufficient to bend the shaft of the motor if you are not careful. Don't pick up the motor by the lap, and do not drop the motor.

4. If you are going to use water to cool the stone and cut down on dust, this is the time to attach the water supply. As I previously stated, I like to use drip irrigation fittings to bring water to my tools. You can either connect directly to a hose bib or have the water in a reservoir above the tool (an old milk jug or plastic container) and let gravity supply the water.

5. Finally, I like to put a shield around the lap. This will keep water from flying all over, and keep your stone from shooting across the room if you should lose your grip on it. I made a shield from an old coffee can and used a piece of wire to hold it in place. I could have just as easily used a piece of plastic or sheet metal and attached it with a large ring clamp.

Using the Lapidary Tool

Once you have assembled your tool, how do you use it? A typical progression of sanding on a softer stone (turquoise, azurite, marble, etc.) is to start with the coarsest sandpaper (60 to 100 grit) to do most of the work in shaping the stone. After that, use each of the progressively finer grits of sandpaper to remove the scratches left by the previous sandpaper. The 220 grit sandpaper removes the 100 grit scratches, and the 400 grit removes the 220 grit scratches, and 600 grit removes the 400 grit scratches.

After the 600 grit, your stone should have a satin finish. Examine the stone closely with a loupe. If you see no visible scratches, move on to the polishing pad. Otherwise, go back to the 220 grit and work your way back up to the 600 grit until you cannot see any scratches under magnification. Polishing compound will

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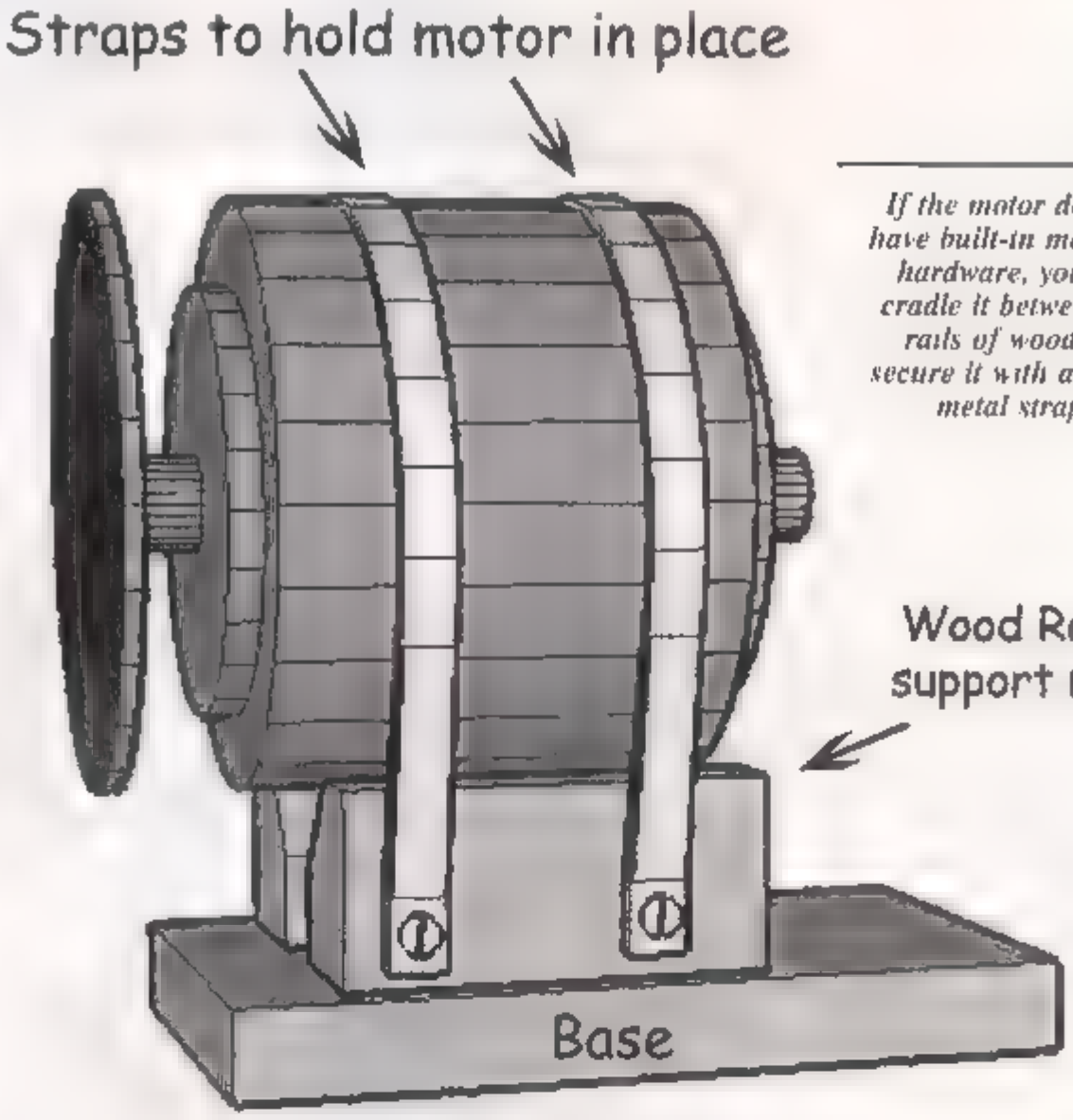


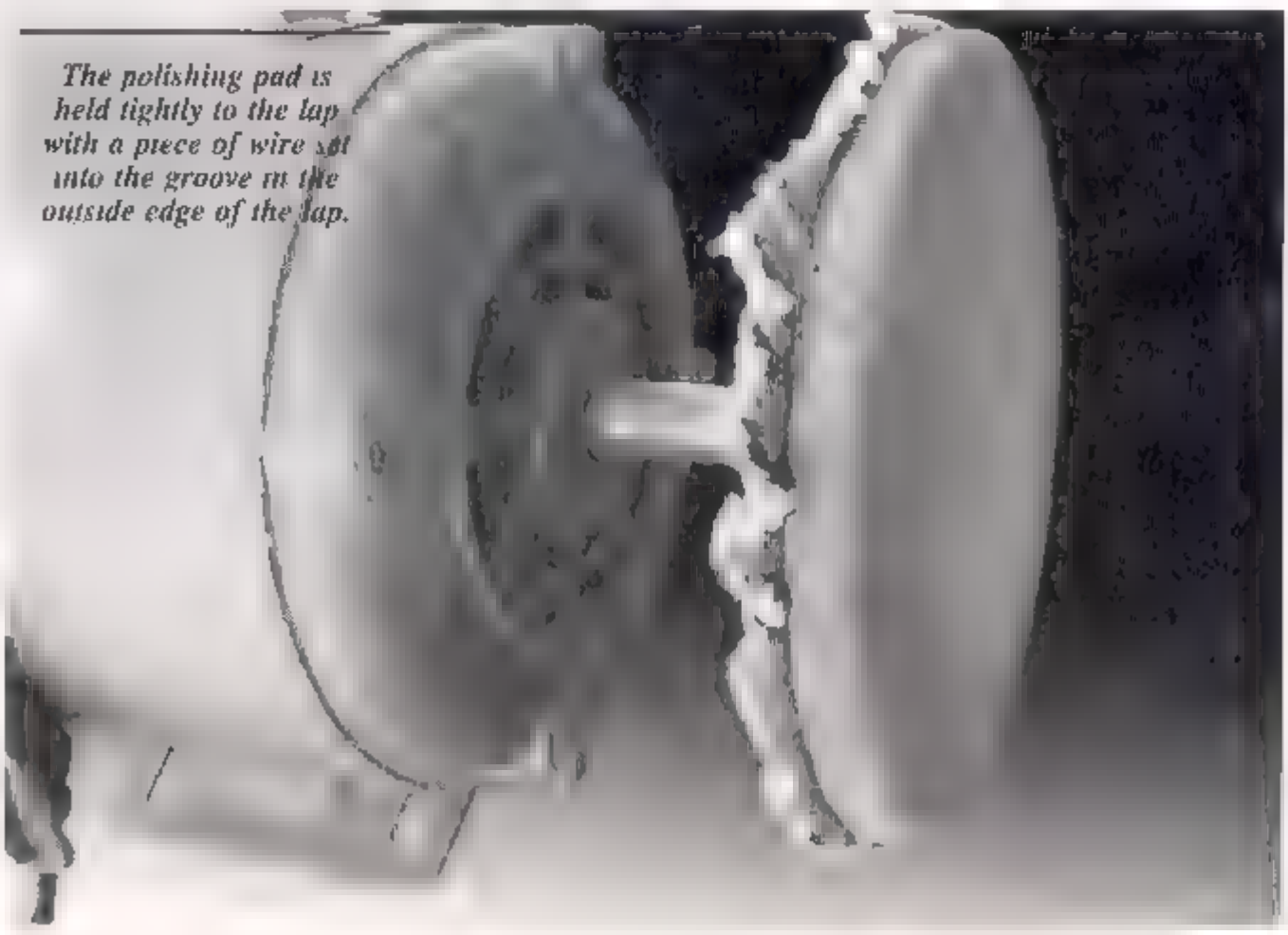
If the motor does not have built-in mounting hardware, you can cradle it between two rails of wood and secure it with a couple metal straps.

not remove scratches from most stones, so if you try and take a shortcut here you will not be satisfied with your final polish.

Between each step, be sure to wash the stone and lap to make sure there are no little bits of old grit left to scratch up your work.

Finally, attach the lap with the canvas or leather polishing pad. Spray a little water on the pad, and sprinkle a little polishing compound on the lap. (I like to use a large salt shaker for the compound.) Rub it into the lap with your hand to make sure it sticks to the lap. It should be a relatively dry paste. Turn on the machine and polish the stone against the lap. It is a combination of heat and abrasion that polishes the stone. You may want to have a small bowl of cool water on hand to dip the stone into if it gets too hot to handle.

I hope this article has helped a few of you to realize that a little Yankee ingenuity can save you quite a bit of money when getting into the lapidary hobby, and that you do not need to be an engineer to make a useful multipurpose lapidary tool.

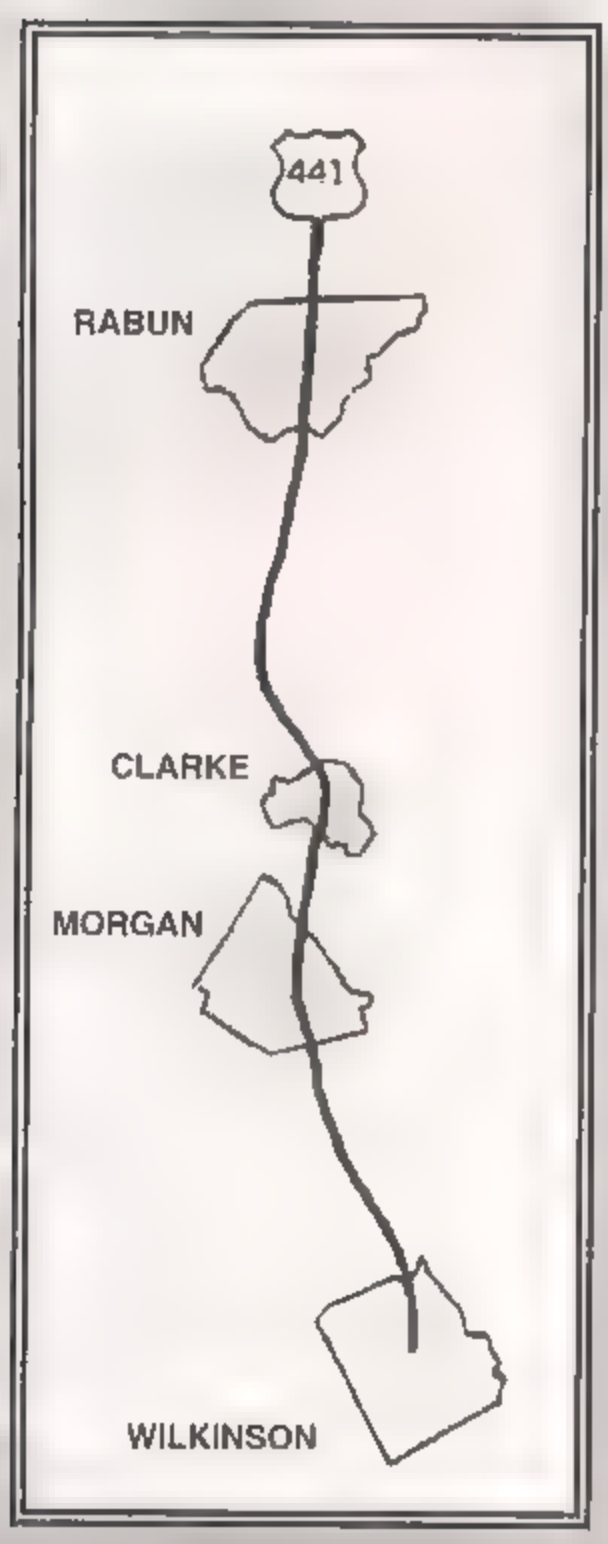


The polishing pad is held tightly to the lap with a piece of wire set into the groove in the outside edge of the lap.

GOLD AND GEM HIGHWAYS

PANNING SITES ALONG U.S. HIGHWAY 441

Great Gem and Mineral Spots in Georgia



by David and Clois Walker

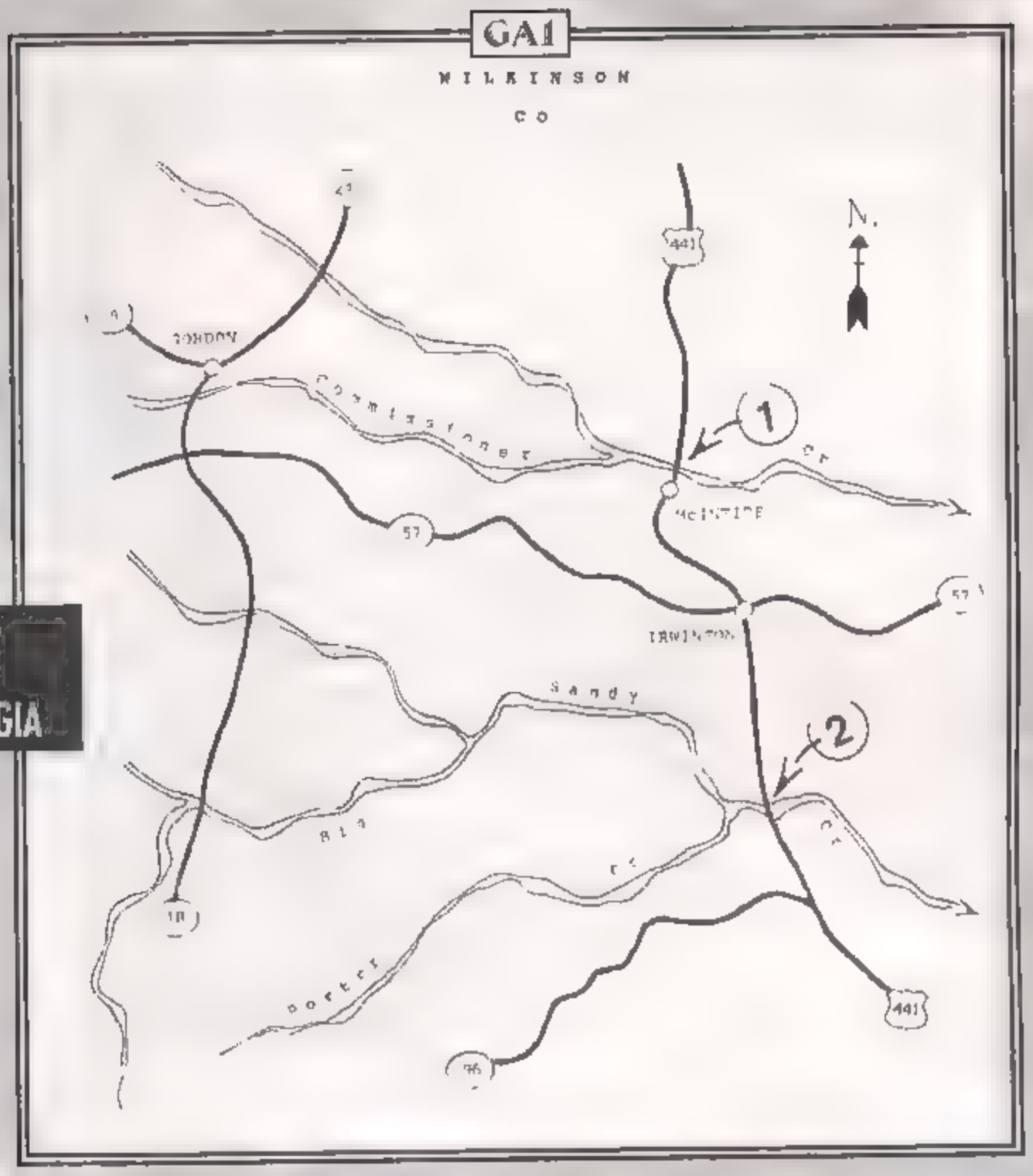
The emphasis in this series is on the convenience afforded by limiting panning and screening operations to within prescribed highway rights of way, rather than having to negotiate terms and conditions with private land or mine owners, more and more of whom are becoming less and less cooperative. However, hobbyists must still observe the safety and environmental regulations imposed by state highway departments, applicable to tourists and rockhounds alike.

Having already completed a study on the gem and mineral potential in Georgia, it was comparatively easy for us to ascertain the areas in which appreciable deposits are readily accessible by U. S. Highway 441. This route embraces a total of six highway/stream crossings, angling generally south from McIntyre to Wiley.

A categorical summary of the sites selected by plotting the intersection of watersheds and U. S. Highway 441 follows, and includes site by-site listings of the minerals and gems previously reported there, which can be reasonably anticipated in downstream float through continuing erosive sequences.

Though we have relied on erosion patterns rather than personal field trips to compile this data, it appears to have been acceptable to the libraries and patrons who have requested our maps. Therefore, we feel confident that other rockhounds will find the information useful.

SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 441 IN WILKINSON COUNTY, GEORGIA



LOCATION AND VICINITY FINDS ALONG U.S. HIGHWAY 441 IN GEORGIA

Wilkinson County (Map GA1)

Site 1. Crossing on Commissioner Creek, near McINTIRE. Vicinity finds indicate quartz potential.

Site 2. Crossing on Big Sandy Creek, near IRWINTON. Vicinity finds indicate quartz potential.

Morgan County (Map GA2)

Site 1. Crossing on Labor Creek, near MADISON. Vicinity finds include aquamarine and quartz.

Site 2. Crossing on Big Sandy Creek, near MADISON. Vicinity finds indicate aquamarine potential.

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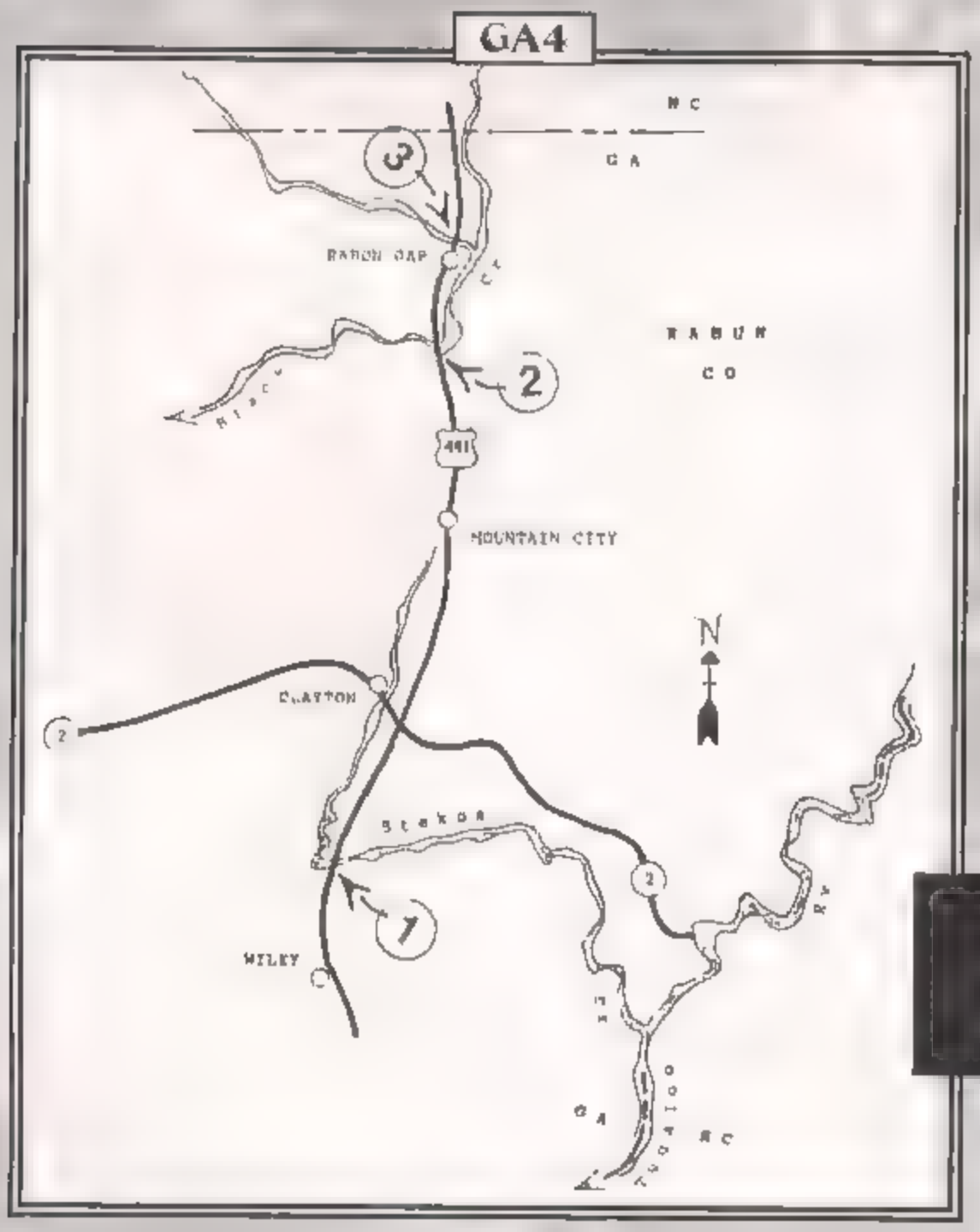
SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 441 IN MORGAN COUNTY, GEORGIA

SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 441 IN CLARKE COUNTY, GEORGIA

Clarke County (Map GA3)
Site 1 Crossing on Oconee River, near ATHENS Vicinity finds include beryl and quartz
Site 2 Crossing on Middle Oconee River, near ATHENS. Vicinity finds include beryl and quartz
Site 3 Crossing on North Oconee River, near ATHENS. Vicinity finds include bery, and quartz

Rabun County (Map GA4)
Site 1 Crossing on tributary of Black Creek, near RABUN GAP Vicinity finds indicate amethyst potential
Site 2 Crossing on Black Creek, near RABUN GAP Vicinity finds indicate amethyst potential
Site 3 Crossing on Stekoa Creek, near WILEY Vicinity finds indicate beryl potential

The official state highway map is suggested for use in conjunction with the vicinity maps for overall orientation in the field



SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 441 IN RABUN COUNTY, GEORGIA

ROCK SCIENCE

by Steve Voynick

CAT-Scanning the Dinosaurs

When modern paleontologists study a particularly valuable fossil, such as a dinosaur skull or an egg, chances are good that they will do exactly what a medical doctor might do for a patient: order a CAT scan.

CAT scans, originally developed as diagnostic medical tools, are taking paleontologists where they could never go before—inside the solid rock of fossils to "see" physiological structures that would otherwise remain hidden.

Earlier paleontologists could only dream about peering into the interior of opaque fossils. In the past, to learn all the secrets of fossils, paleontologists had to literally destroy their priceless specimens. They often slowly and meticulously ground or sliced away the entire fossil, layer by layer, then drew or photographed the details of internal structures as they appeared—and just before they were destroyed. Some researchers even "accidentally" dropped irreplaceable bone fossils, shattering them in order to sneak a look inside.

X-rays gave paleontologists their first chance to study internal fossil features in a nondestructive manner. X ray images are records of differences in density within the objects they penetrate. In familiar medical usage, bones, being considerably denser than tissue, can be easily distinguished.

By the 1930s, paleontologists had begun X-raying fossils and studying the resulting two-dimensional images, which unfortunately showed all internal structures confusingly superimposed. But by the early 1970s, emerging computer technology was bringing an entirely new dimension to medical X-ray diagnosis—computerized axial tomography (CAT or CT), an advanced X ray scanning technique that provided the first three-dimensional, layer by layer looks inside opaque objects.

CAT scan devices emit X-ray radiation from a rotating, donut shaped source, recording the radiation on hundreds and sometimes thousands of individual recorders positioned at various angles opposite the source. Continuous rotation of the X-ray source and recorders produces thousands of individual recordings which later generate digital, cross sectional, composite images that display internal features of an object as if they had been sliced open along different planes. Computers then process the many megabytes of X ray data, displaying on-screen images that may be selecively controlled for viewing internal features from any angle or at any depth.

To minimize human exposure to potentially harmful X radiation, medical CAT scans operate on limited power and at the lowest possible radiation levels. But industrial CAT scans, introduced in the early 1980s, employ far higher levels of X radiation that can penetrate as much as 2 feet of rock. Despite their power, industrial scanners have great sensitivity and are capable of discerning even the most subtle density differentials. Industrial CAT scanners are used to enhance quality control in many manufacturing processes.

By 1985, paleontologists had learned that industrial CAT scans could differentiate the densitometric differences of such delicate fossilized structures as nerve canals and ear passages, visual traces of which are usually lost in the fossilization process. The use of CAT scans in paleontology increased rapidly. In 1988, paleontologists from Utah's Brigham Young University obtained the first-ever CAT scans of a dinosaur embryo within a fossilized egg.

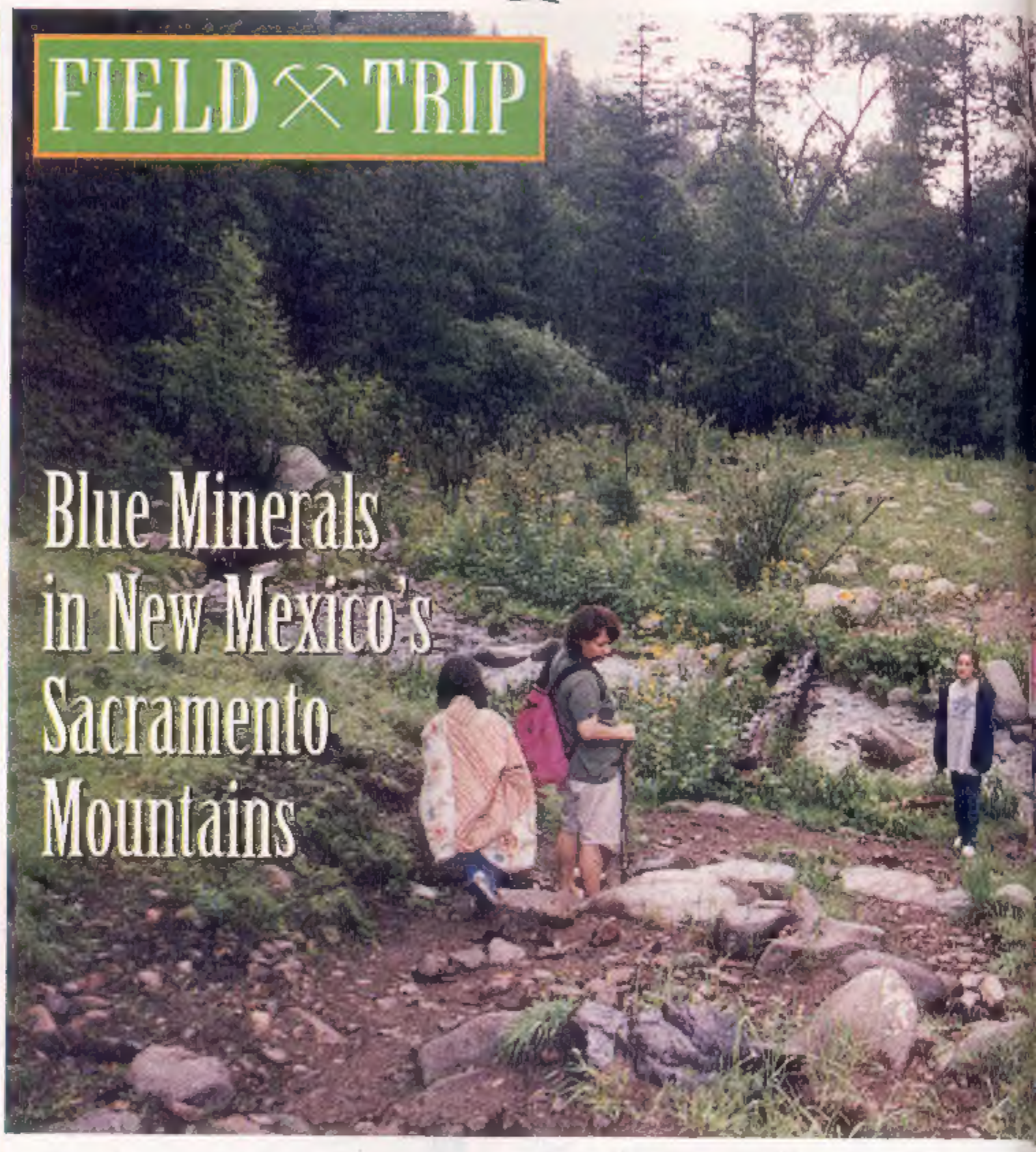
Two years later, a CAT scan peered into a fossilized skull of a Nanotyrannus, a small, distant, early relative of Tyrannosaurus rex. In just a few hours, CAT scans revealed more about the physiology—and by inference, the behavior—of Nanotyrannus than had been learned since the skull had been excavated 40 years earlier.

These CAT scans indicated a predator not at all "dumb" and slow moving, but one that was, in the words of noted paleontologist Robert Bakker, "a creature of unimagined sophistication, a high tech predator that combined the eyes and brains of an eagle with the snout and hearing of a wolf." Visible in the CAT scan images were many subtle and previously unknown skull features that served an advanced nervous system remarkably similar to those of modern birds.

Today, paleontologists order CAT scans on virtually all scientifically significant fossilized skulls and eggs. The resulting digital CAT scan images are the next best thing to being able to study the actual soft tissues of the original animal.

Bluefront Canyon Co

FIELD TRIP



Blue Minerals in New Mexico's Sacramento Mountains

by Robert Beard

Blue is a striking mineral color. Some of the most valuable minerals and gemstones, from azurite to sapphire, are blue. Other beautiful blue minerals include sodalite, kyanite, blue agate, blue barite, lapis lazuli (lazurite), blue corundum, and lazulite. A locality with blue minerals is often popular if collectors can find or get to it.

Nearly all the sites with blue minerals that I know of are well documented in mineral collecting guides, and therefore have generally been heavily collected. However, I recently learned of a little-known locality for blue corundum and lazulite in south central New Mexico that was both accessible and had an abundance of blue minerals. This is the former Bluefront Mine in Bluefront Canyon, located just northwest of Ruidoso in the Sacramento Mountains of Lincoln County.

This locality is not described in any southern New Mexico mineral guides that I am familiar with, and I learned of it through Dr. Virgil Leuth of the New Mexico Bureau of Geology and Mineral Resources in Socorro. Virgil is the state mineralogist, and is a tremendous source of knowledge about minerals in New Mexico.

While discussing mineral localities at the November 2001 New Mexico Mineral Symposium in Socorro, I asked him about lazulite in New Mexico. I had come across some of his abstracts (short papers) on lazulite in southern New Mexico when searching for mineral localities over the Internet. They can be found at www.geoinfo.nmt.edu/staff/lueth/abstracts/abstracts99.htm. Virgil had described lazulite occurrences in the Organ Mountains, near Las Cruces, and in the Sacramento Mountains, near Ruidoso.

I was originally interested in the lazulite locality in the Organ Mountains, since it is close to my wife's family home in Sunland Park, which is where we usually stay while in New Mexico. However, Virgil indicated that this locality is extremely remote and required at least two days of backpacking to get to it. This did not seem like a good choice for a family trip, since my wife has made no secret of her dislike for backpacking. My kids are also old enough to have made known their dislike for extended mountain trips. The other downside is that when you go on a trip like this to a remote locality, there is a good chance that you will not find it. I did not want to risk two days of my vacation for such an uncertain outcome.

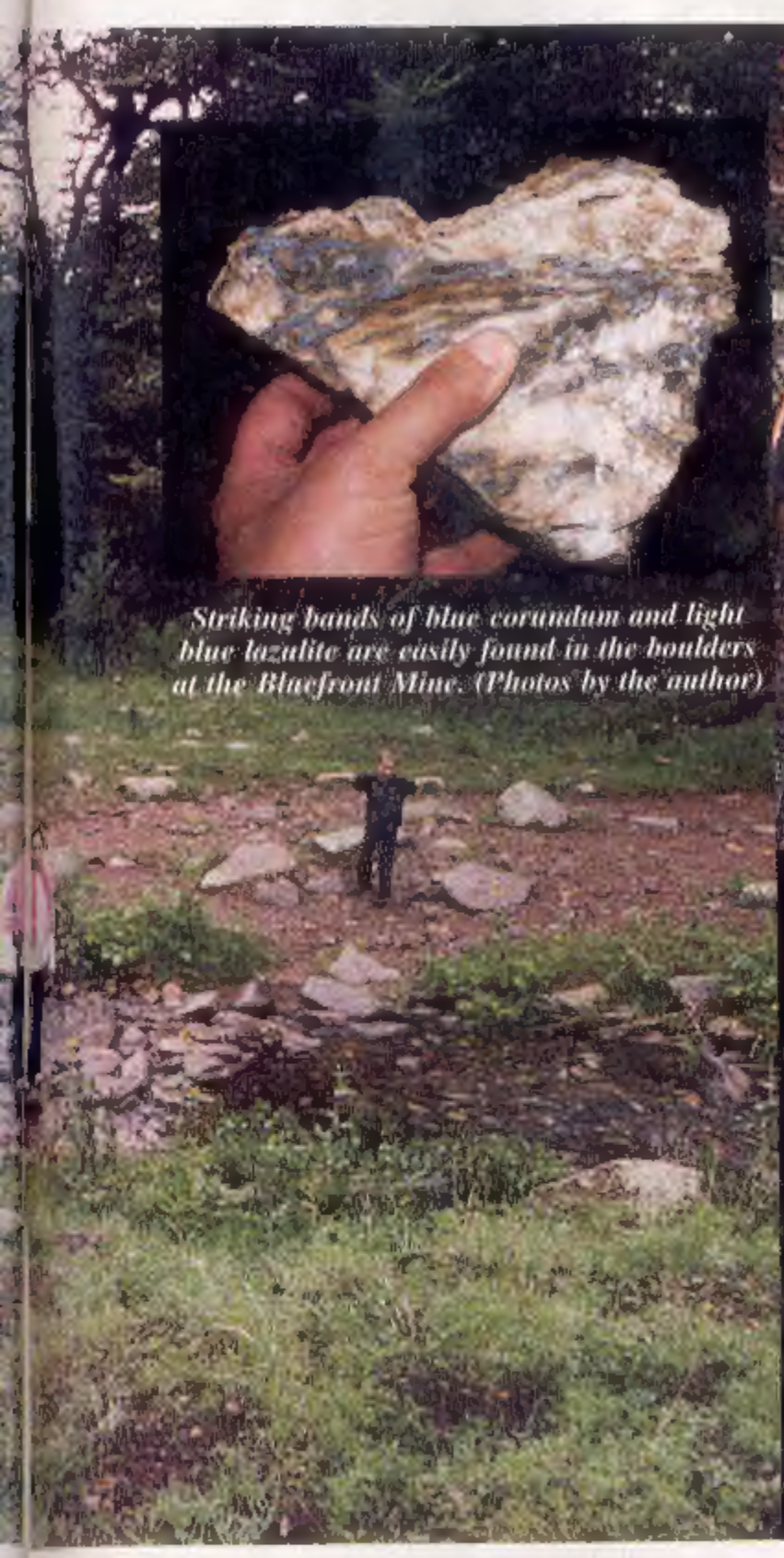
However, the Sacramento Mountains locality sounded more promising. I later learned that this lazulite occurrence is in Bluefront Canyon, in Lincoln National Forest near the White Mountains Wilderness Boundary. This locality has blue corundum as well as lazulite. Virgil's abstract indicated that it had been quarried for building stone around 1904, but the stone did not hold up well and quarrying was stopped. Virgil said that the site was reasonably accessible, and that you could easily hike to the site from a trailhead at a parking area. This sounded like my best bet.

Before I plan a collecting trip for a mineral, especially one I know little about, I do some research. I knew that corundum was the mineral that formed rubies and sapphires, but all I knew about lazulite was that it was blue and had a name that sounded like lapis lazuli, which is also known as lazurite. Both lazulite and lazurite are relatively uncommon, and were not minerals that were taught in my mineralogy classes as an undergraduate geology major.

Corundum is aluminum oxide (Al_2O_3), and represents 9 on the Mohs Scale of Hardness. Its color varies, but is usually some shade of brown, pink or blue. It is a relatively common accessory mineral in metamorphic rocks, but gem-quality sapphires and rubies are among the most valuable of gemstones. According to Dana's *Manual of Mineralogy*, 19th Edition, the name corundum may have come from kauruntaka, which is the Indian name for the mineral.

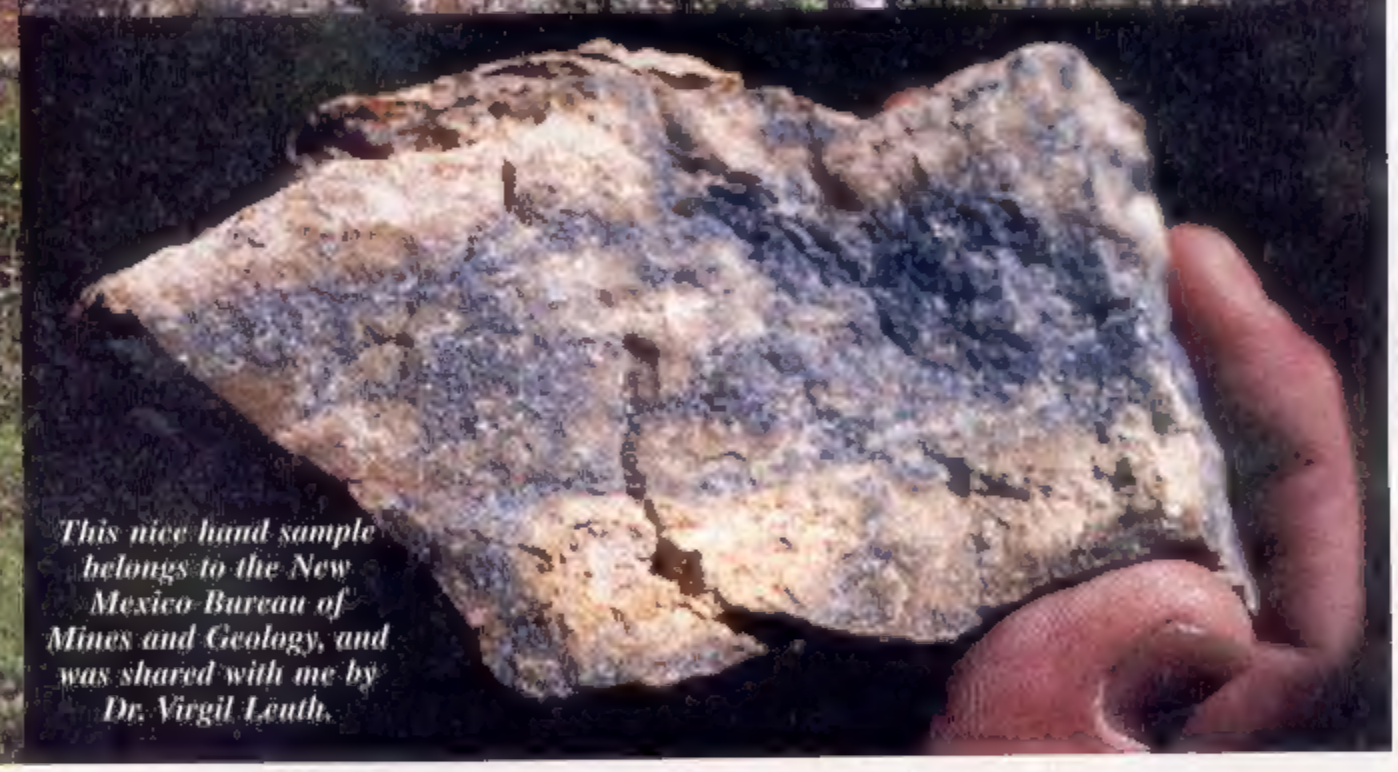
Lazulite is a magnesium-iron aluminum phosphate, and has the chemical formula $(Mg, Fe)Al_2(PO4)_2(OH)_2$. Its color ranges from sky blue to Prussian

undum and Lazulite



Striking bands of blue corundum and light blue lazulite are easily found in the boulders at the Bluefront Mine. (Photos by the author)

Chemical alteration by hydrothermal fluids during late-stage crystallization of a granitic magma may have formed the lazulite veins.



This nice hand sample belongs to the New Mexico Bureau of Mines and Geology, and was shared with me by Dr. Virgil Leuth.

blue. It is in the monoclinic crystal system, and has a hardness of Mohs 5-6. Among the most famous lazulite crystal localities in United States are Graves Mountain, Georgia, Crowder's Mountain, North Carolina, and the White Mountains in California. Important international localities include Salzburg, Austria, and Horrsjoberg, Sweden. In Canada, the Rapid Creek area of British Columbia has produced good crystals. Interestingly, all of the locality guides I have checked do not mention the occurrences in New Mexico.

The name lazulite is from an Arabic word azul, which means heaven, and the Greek word lithos, which means stone. The mineral is sometimes referred to by other names, including blue zeolite, blue feldspar, and azure spar. It is often confused with lazurite, although the only similarities between the two are spelling and blue color. Lazurite is a tectosilicate and is typically associated with pyrite, while lazulite, a phosphate, is usually not associated with pyrite.

The locality is in the White Mountain (Sierra Blanca) range, which is a subrange of the Sacramento Mountains. Some maps call only the mountains south of U.S. Highway 70 the Sacramento Mountains, but U.S. Geological Survey (USGS) maps include all of the mountains from a point 40 miles north of the Texas border to the north end of the Jicarilla Mountains as the Sacramento Mountains. The subranges are the Jicarilla, Capitan, White Mountain, and Sacramento Mountain ranges. For consistency with the USGS, I will continue to refer to the area as within the Sacramento Mountains.

The geology of the area is dominated by a huge Tertiary-age intrusion that forms the core of the White Mountain range and Sierra Blanca Peak. This intrusion shows up on the various geologic maps for the region as a gigantic area of red (the typical color for intrusive igneous units) and it is shown as intruding Tertiary- and Cretaceous-age sediments and volcanics. Virgil indicated that phosphate metasomatism (chemical alteration by hydrothermal fluids) associated with late-stage crystallization of a granitic magma may have resulted in the formation of the lazulite veins. However, he stated that alteration of a phosphate-rich host rock was also possible. The topography is very steep, and the heavy forest cover further obscures the relationship between the rocks. Fluids from the intrusion have also heavily altered many of the rocks, so it is a difficult area to map and interpret.

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Bluefront Canyon Corundum and Lazulite *from page 81*

I made plans to visit the Sacramento Mountains locality in July 2002. Unfortunately, I did not bother to get specific directions from Virgil at the symposium, as I figured I could find Bluefront Canyon easily on topographic or U.S. Forest Service maps. When planning my trip, I went to Rollag & Associates Inc. in El Paso (915-533-6277), which is my standard source for topographic, Forest Service, and Bureau of Land Management maps in the southern New Mexico area.

Unfortunately, some of the USGS 7.5-minute quadrangles for the area in which I suspected Bluefront Canyon was were out of stock. I then checked the U.S. Forest Service maps for the area, and finally found Bluefront Canyon on a map entitled "White Mountain Wilderness, Lincoln National Forest." However, although I could find Bluefront Canyon, I could not identify where the lazulite locality would be. The person at Rollag then ran a search using a map search program, and to my amazement actually found a spot called Bluefront Mine. This had to be the lazulite locality, as it was the only mine in Bluefront Canyon. The site is located near the center of Section 14, T. 10 S., R. 11 E. (Township 10 South, Range 11 East).

As soon as I got back to Sunland Park, I made arrangements with my wife, Rosalina, for a family trip to Bluefront Canyon. We would take our two kids and two teenage nieces. This would be very different than many of our New Mexico trips, as it would be in heavily wooded mountains. I reasoned that, since we could drive right to the trailhead and hike over what appeared to be level ground for only about one mile, this would be an easy trip and I would not get yelled at. I would later find that I had deceived myself again.

We left for the site on a Saturday morning in late July 2002. The drive from Sunland Park to Ruidoso is pleasant, and for most of the way is straight through the desert of the Tularosa Valley. White Sands, another good family trip, is just off the highway between Las Cruces and Alamogordo. It was a nice sunny day in the desert, but I could see storm clouds building over the Sacramento Mountains. I hoped that we would not get caught in a big storm on the trail.

Ruidoso is a big skiing town, and during the summer it is still packed as a base for hiking and fishing trips to the mountains. It is a far cry from the ghost towns I usually encounter on most of my trips in New Mexico. We left Ruidoso and continued driving up winding mountain roads to get to the trailhead. All these roads require only two-wheel drive during the summer, and you do not need any special vehicles to get to the trailhead.

We soon arrived at the parking area for the trailhead. Things went downhill as soon as we got out of the car. Although it was summer, the mountains were very cold. The clouds had descended, and the parking lot was foggy and misty. The air was saturated with moisture and a downpour seemed imminent. I did not bring any warm clothes, and was wearing shorts and a short-sleeved shirt.

The kids then started to fight, and Rosalina was mad because she was cold. She was also sure that lightning would start at any second. The rumble of thunder in the distance put her even more on edge. She wanted to stay in the car with the kids, but I pleaded with her to come on the trail. It made no sense to spend three hours driving up here to sit in the car in the rain. We would likely never have the chance to come back here.

Somehow, we got onto the trail. My wife and kids kept falling farther behind, while my nieces and I continued walking. Rosalina wanted to stop and go back, but I kept us moving along. There was a very slight rain, but the humidity was such that I was becoming soaked, and it was cold. I had not counted on these conditions.

I had a Magellan GPS unit, and it gave me useful information on our location. I knew we were getting closer, but we were still a little farther away than I had hoped. The trail soon became steeper and slippery, and I was catching more and more flak from the rear. "How much farther is it? How much farther is it?" My reply was always "Not much, we are almost there. Just a little bit farther." It was like I was driving.

We encountered a few other people on the trail, so at least we knew we were not in a remote area. Finally, we came to a clearing, and based on my map I knew the Bluefront Mine was nearby. I looked to the north and saw a distinct pile of rocks in the mist. It did not look natural and resembled a small mine dump.

It had better be the place, I thought, as I was out of time. Everyone seemed to be screaming at me, but in reality I think it was only my wife. I walked up to the pile and picked up a rock. It was unlike anything I had seen before. Most of the rock was white, but it had distinct irregular, light-blue bands. This was the corundum and lazulite of the Bluefront Mine.

I thought that Rosalina would like to see what we had came for, but by now she was so angry that that she would not even walk the last 50 feet to the mine. However, the rest of us did not come all this way for nothing. My son, my nieces, and I walked around the pile to pick up some interesting pieces.

The pile was like a typical rock pile at a

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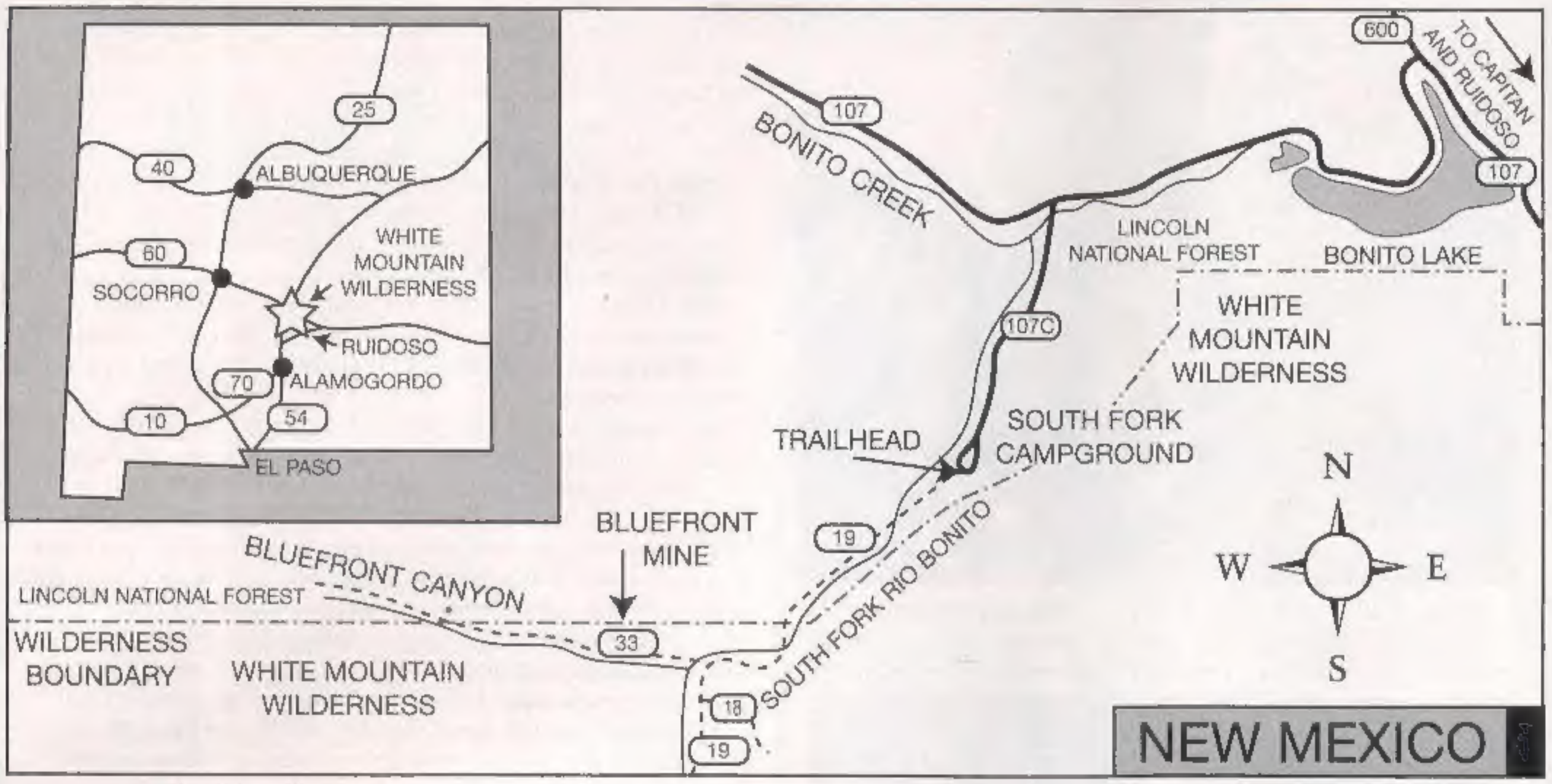

small roadside quarry, except the rocks were covered with moss and lichen, and were laced with blue. I broke off some fresh pieces and found that the blue occurred in irregular veins throughout the rock. The host rock appeared to be some kind of white to gray granitic or metamorphic rock. I knew our time was limited, as everyone was wet and cold, so I did not spend a lot of time trying to figure out what it was. I broke off some of the best pieces I could find and stuffed them in my backpack.

A few minutes later, a man and woman showed up with their dog. Unfortunately, Rosalina is scared of dogs, and this was the final straw. She began walking back to the car with the kids, and I was left at the pile.

The man was with an oil company from southern New Mexico. Even with his background in geology, he was not sure what the blue mineral was. He thought it might be related to silver mineralization, which was not a bad guess, but not quite correct, either. I asked him if he knew of any collecting restrictions, since the mine was so close to the White Mountains Wilderness. He said he was sure there was no problem with collecting some samples; he had previously collected some beautiful pieces for his garden.

We soon left and got back into the car. Once we were in the car, everything was fine. We even drove to some other mine sites that are marked on the White Mountains Wilderness map, but these were completely picked over. As we drove farther on the roads into the mountains, many of which were not paved, the surface quality got worse. These roads were becoming more suited for four-wheel drive. It soon started raining even harder, and we finally called it quits.

Since I had been in such a forced hurry to collect, I had spent maybe a total of 10 minutes at the site. It was a shame, since it took several hours of planning and driving to get there, but it was pretty standard as far as many of my family collecting trips go. As usual, when I checked the rocks that I had packed out, I wished that I had spent a little more time getting better pieces. Even so, the pieces I had grabbed were pretty good. I had several nice pieces with blue banding and many small pieces of blue corundum with minor lazulite.

The main rock pile at the Bluefront Mine looks like a talus pile, but closer inspection shows it is man-made.

Even though I had my GPS unit, I had not learned how to record my traverses, and unfortunately did not write down the coordinates of the site. However, using topographic mapping from Topozone (www.topozone.com), I was able to locate the spot that I recalled was the Bluefront Mine. The latitude and longitude of the site are 33.4406° N, 105.7696° W, and the USGS 7.5-minute quadrangle is Nogal Peak. This quadrangle also shows Bluefront Canyon, but does not show the mine. The latitude and longitude may not be exact, but they should certainly be close enough to get you to the mine.

During the New Mexico Mineral Symposium in November 2002, I showed Virgil some of my pieces, and he confirmed that we did go to the right spot. He showed me one of the pieces he had collected for the museum, and pointed out the lazulite. The lazulite, it turns out, is very minor when compared to the corundum. The lazulite is a distinct light blue, while the corundum is a darker blue.

It was easy to see why this material did not hold up as a building stone. Virgil described the host rock is an altered quartzite, and the rock contains alunite, which has a hardness of 4, while the corundum has a hardness of 9. Rocks with a strong hardness contrast between their minerals generally do not make good building stones, as the soft minerals weather away while the hard minerals stick out. I am curious if any early 1900s homes or buildings in Ruidoso or the surrounding area have any of the blue-banded stones on their facades. They would be easy to spot if you are familiar with the appearance of the stone.

Fortunately, its lack of value of a building stone has preserved it for collecting. The Bluefront Canyon corundum-lazulite locality is an excellent place to combine some hiking with rock collecting. Since it is so obscure, you do not have to worry about it being over-collected or over-visited. But remember to come prepared with warm clothes and raingear, and make sure that your collecting partners know what you are getting them into.